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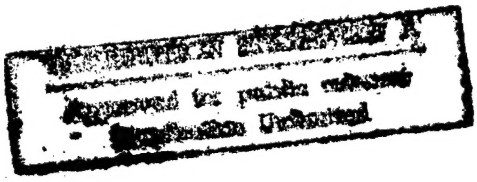
China Report

SCIENCE AND TECHNOLOGY



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CHINA REPORT
SCIENCE AND TECHNOLOGY

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NATIONAL DEVELOPMENTS

PRC PROMULGATES NEW PATENT LAW

OW160641 Beijing XINHUA Domestic Service in Chinese 0900 GMT 13 Mar 84

[Text] Beijing, 13 Mar (XINHUA)--Patent Law of the People's Republic of China

[Adopted by the fourth meeting of the Standing Committee of the Sixth National People's Congress on 12 March 1984)

Chapter I: General Provisions

Article 1: This law is formulated in order to protect patent rights for inventions and creations, encourage inventions and creations, help promote their popularization and application, and accelerate the development of science and technology to meet the requirements of socialist modernization.

Article 2: "Inventions and creations" mentioned in this law mean inventions, practical new models and exterior designs.

Article 3: The Patent Bureau of the People's Republic of China accepts and examines patent applications and awards patent rights to inventions and creations which meet the provisions of this law.

Article 4: Applications for patents on inventions and creations that involve national security or major interests and which must be kept secret shall be handled according to relevant provisions of the state.

Article 5: Patent rights will not be awarded to inventions and creations which violate state laws and social morality or jeopardize public interests.

Article 6: For job-related inventions and creations accomplished while carrying out the tasks of a unit or when using the material conditions of the unit, the right to apply for a patent belongs to the unit. For nonjob-related inventions and creations, the right to apply for a patent belongs to the inventor or designer. Upon approval of an application, if the applicant is a unit owned by the people, the patent rights shall be held by that unit; if the applicant is a collectively owned unit or an individual, the patent rights shall be owned by that unit or individual.

For job-related inventions and creations accomplished by persons working for foreign enterprises or Chinese-foreign joint ventures in China, the right to apply for a patent belongs to the enterprises and joint ventures. For nonjob-

related inventions and creations, the right to apply for a patent belongs to the inventor or designer. Upon approval of an application, the patent rights shall be owned by the applicant enterprise or individual.

Holders and owners of patent rights are all referred to as patentees.

Article 7: No unit or individual may suppress the application for patents by an inventor or designer for nonjob-related inventions or creations.

Article 8: For inventions and creations accomplished by two or more cooperating units or by one unit entrusted by other units to carry out research or design tasks, the right to apply for patents belongs to the accomplishing unit or jointly accomplishing units, unless there are other agreements. Upon approval of an application, the patent rights shall be owned or held by the applicant unit or units.

Article 9: When two or more applicants separately apply for a patent on the same inventions and creations, the patent rights will be awarded to the first applicant.

Article 10: The right to apply for patents and patent rights may be transferred.

To transfer its right to apply for patents or its patent rights, a unit owned by the whole people must obtain approval by a responsible organization at a higher level.

To transfer the right to apply for patents or patent rights to foreigners, a Chinese unit or individual must obtain approval by the relevant responsible department of the State Council.

To transfer the right to apply for patents or patent rights, the parties concerned must sign a written contract, which will become effective after registration at the Patent Bureau and a public announcement.

Article 11: After patent rights for inventions and practical new models are graded, except for those provided by Article 14 of this law, no unit or individual without the permission of the patentees may apply their patents; that is, to produce, use or market their patented products for production or business purposes, or to use their patented methods.

After patent rights for exterior designs are grated, no unit or individual without the permission of the patentees may apply their patents; that is, to produce or market products of their patented exterior designs for production and business purposes.

Article 12: To apply the patents of others, except for those provided by Article 14 of this law, a unit or individual must sign a written contract with the patentees granting permission for such applications and pay patent-use fees to the patentees. The party granted permission to use a patent has no right to permit any unit or individual other than those provided for by the contract to apply that patent.

Article 13: After application for patents for inventions is announced, the applicant may demand the unit or individual applying his inventions to pay appropriate fees.

Article 14: On the basis of state plans, responsible departments concerned of the State Council and provincial, autonomous regional, and municipal people's governments have the power to decide on permitting designated units to apply the patents of important inventions and creations held by units owned by the whole people in their own system or under their jurisdiction, in which case the applying units should pay user fees to the patent-holding units according to state provisions.

Patents owned by Chinese collectively owned units or individuals, which have great significance to national or public interests and need to be popularized and applied, should be reported to the State Council by the department of the State Council responsible for approval to be handled according to the provisions of the previous article.

Article 15: Patentees have the right to indicate patent marks and numbers on patented products or their packages.

Article 16: Units owning or holding patent rights should reward the inventors or designers for job-related inventions and creations. After inventions and creations in use, the inventors and designers should be rewarded according to the scope of popularization and application and the economic results obtained.

Article 17: Inventors or designers have the right to identify themselves as the inventors or designers in patent documents.

Article 18: Foreigners, foreign enterprises, or other foreign organizations with no regular residences or offices in China who apply for patents in China should be handled according to agreements between their countries and China, or international treaties to which both their countries and China are signatories, or according to this law on the principle of mutual benefit.

Article 19: Foreigners, foreign enterprises, or other foreign organizations with no regular residences or offices in China who apply for patents and handle other patent affairs in China should entrust a patent agency designated by the State Council of the People's Republic of China to act on their behalf.

When Chinese units or individuals apply for patents and handle other patent affairs in the country, they may entrust a patent agency to act on their behalf.

Article 20: When Chinese units or individuals apply for patents in foreign countries for inventions and creations accomplished in China, they should first apply for patents at the Patent Bureau and obtain the endorsement of the responsible departments of the State Council concerned, and then entrust a patent agency designated by the State Council to act on their behalf.

Article 21: Before a patent application is published or announced, Patent Bureau staff members and other related personnel have the responsibility to keep its contents secret.

Chapter II: Conditions for Awarding Patent Rights

Article 22: To be granted patent rights, inventions and practical new models should have the characteristics of newness, originality and practicality.

Newness means that no similar invention or practical new model has been published in domestic or foreign publications or publicly used domestically, or has been made known to the public of other ways, before the date of application, and that no patent application has been submitted to the Patent Bureau by others on a similar invention or practical new model which is on record in the patent application document made public after the date of application.

Originality means that compared with the technology in existence before the date of application, the invention has outstanding and substantial distinguishing features and represents a marked improvement, and the practical new model has substantial distinguishing features and represents an improvement.

Practicality means that the invention or practical new model can be manufactured or used and can produce positive results.

Article 23: To be granted patent rights, an exterior design should not be identical or similar to any exterior design which has been published in domestic or foreign publications, or has been publicly used domestically before the date of application.

Article 24: Inventions and creations for which patents are being sought do not lose their newness if one of the following circumstances occured within 6 months before the date of application:

a. They were displayed for the first time at an international exhibition sponsored or recognized by the Chinese Government;

b. They were published for the first time at specific academic or technological meetings; and

c. Their details were revealed by others without the consent of the applicants.

Article 25: The following items will not be granted patent rights:

a. Scientific discoveries;

b. Rules and methods of intellectual activities;

c. Methods of diagnosis and treatment of diseases;

d. Foodstuffs, beverages and seasonings;

e. Medicines and materials obtained by chemical methods;

f. Breeds and varieties of animals and plants; and

g. Materials obtained by methods of nuclear mutation.

Patent rights may be granted to the production methods of the products listed in items D-F in the above article in accordance with provisions of this law.

Chapter III: Application for Patents

Article 26: Applicants for patents for inventions or practical new models should submit an application, a written explanation and its summary, a claim of rights, and other documents.

The application should clearly indicate the name of the invention or practical new model, the name of the inventor or designer, the name and address of the applicant, and other matters.

The written explanation should clearly and completely explain the invention or practical new model in such a way that it can be understood by technicians in related technological fields. When necessary, drawings should be attached. The summary should briefly explain the main technical points of the invention or practical new model.

The claim of rights should clearly state the scope of patent protection requested on the basis of the written explanation.

Article 27: Applicants for patents for exterior designs should submit an application, drawings or photos of the exterior design, and other documents and should clearly indicate the product which uses the exterior design and the category to which it belongs.

Article 28: The date of application is the day on which the application documents are received by the Patent Bureau. If the application documents are mailed, the date on the outgoing postal stamp is the date of application.

Article 29: A foreign applicant applying for patent in China within 12 months from the date of his first patent application in a foreign country for the same invention or practical new pattern, or within 6 months from the date of his first patent application in a foreign country for the same invention or practical new pattern, or within 6 months from the date of his first patent application in a foreign country for the same exterior design, may enjoy the right of preference; that is, to use the date of his first application in the foreign country as the date of his application in China, according to the agreement signed between his country and China or the international treaty to which both countries are signatories, or according to the principle of mutual recognition of preference right.

For the applicant claiming the right of preference, if one of the circumstances mentioned in Article 24 of this law has occurred, the time limit for preference right will be counted from the date of the occurrence of that circumstance.

Article 30: The applicant who claims preference right should submit a written statement at the time of application indicating the date of his application in a foreign country and naming the country that accepted his application, and should submit copies of the original application documents certified by the

accepting organization of that country within 3 months. Failure to submit a written statement or failure to submit the documents within the limit will be regarded as failure to claim preference right.

Article 31: One patent application or invention or practical new model should be limited to one invention or practical new model. Two or more inventions or practical new models which belong to a general inventional concept can be included in one application.

Patent application for exterior design should be limited to one exterior design used for one product. Two or more exterior designs which are used for products of the same category and sold or used in sets can be included in one application.

Article 32: An applicant may withdraw his patent application at any time before patent rights are awarded.

Article 33: An applicant may revise the documents and application for a patent, but such revision must not exceed the scope listed in the original written explanation.

Chapter IV: Examination and Approval of a Patent Application

Article 34: After receiving the application for an invention patent, and after a preliminary examination, if the Patent Bureau thinks that such application meets the requirements of this law, it should make the application public within 18 months of the date of application. The Patent Bureau may make the application public at an earlier date at the request of the applicant.

Article 35: Within 3 years from the date of application for an invention patent, the Patent Bureau may conduct a substantive examination at any time over the application at the request of the applicant. If the applicant has no valid reason for failing to file such a request for a substantive examination, this application is considered withdrawn.

If it is deemed necessary, the Patent Bureau may conduct a substantive examination of any invention patent application on its own.

Article 36: When an applicant for any invention patent applies for a substantive examination, the applicant should submit reference materials regarding his invention that are dated before the application date.

When an applicant applies for a substantive examination of an application for an invention patent which has already been applied abroad, he should submit reference materials from that nation on checking the application he filed there or other reference materials showing the results of the examination. If such materials are not submitted, for no valid reason, this application is considered withdrawn.

Article 37: If the Patent Bureau believes that after conducting a substantive examination, this application for an invention patent does not conform with the stipulations of this law, it should notify the applicant and request that the latter state his opinions within a designated time limit or revise his application. This application is considered withdrawn if for no valid reason the applicant fails to reply within the time limit.

Article 38: After the applicant states his opinions or revises his application for an invention patent, the Patent Bureau should turn down the application if it still thinks that the application does not conform with the sitpulations of this law.

Article 39: If the Patent Bureau finds no reason to turn down the application for an invention patent after a substantive examination, it should notify the applicant.

Article 40: Having received an application for a practical new model or exterior design patent and having thought, after a preliminary examination, that such application meets the requirements of this law, the Patent Bureau may grant approval, make an announcement, and notify the applicant immediately without conducting a substantive examination.

Article 41: Within 3 months of the date of the announcement of the patent application, any dissident may file his objection with the Patent Bureau against this application as stipulated by this law. The Patent Bureau should send a copy of this objection to the applicant, who must give a written reply within 3 months of the date of receipt of the copy of objection. The application is considered withdrawn if for no valid reason the applicant fails to submit his written reply within the time limit.

Article 42: If the Patent Bureau thinks the objection is well founded, it should make its decision to reject the application and notify the dissident as well as the applicant.

Article 43: The Patent Bureau sets up a Patent Review Committee. Within a period of 3 months after the applicant has received the notice of rejection, any applicant who disagrees with the Patent Bureau's rejection of his application may file a request with the Patent Review Committee to reexamine the application. After reexamining the application, the Patent Review Committee makes a decision and notifies the applicant.

If an applicant for an invention patent disagrees with the Patent Review Committee's rejection, he may file a complaint with the people's court within 3 months after he receives the notice of rejection.

The Patent Review Committee's decision on an applicant's request for re-examination of a practical new model, or an exterior design, is final.

Article 44: When there is no objection to a patent application, or when the objection is found to be invalid during the reexamination, the Patent Bureau should make a decision on granting the patent, issuing the patent certificate, and registering and publicizing the related matters.

Chapter V: Time Limit, Termination and Nullification of a Patent

Article 45: The time limit for an invention patent is 15 years. The period is counted from the day an application is submitted. The time limit for a patent for a practical new model, or an exterior design, is 5 years, and the period is counted from the day an application is submitted. Before a patent expires, the patent holder may apply for an extension of 3 years.

The time limit for a patent, for which a patent holder claims the preference right, begins from the day it is applied for in China.

Article 46: A patent holder should begin to pay annual dues from the year the patent is granted.

Article 47: A patent is terminated before its expiration date if a) annual dues are not paid according to regulation; or b) the patent holder, by a written statement, gives up the patent.

The termination of a patent shall be registered and publicized by the Patent Bureau.

Article 48: After a patent is granted, any unit or individual who thinks that the granting of the patent is incompatible with the provisions of this law, may request the patent review committee to declare the patent null and void.

Article 49: The Patent Review Committee reexamines the request for declaring a patent null and void, makes a decision and notifies the requester and the patent holder. The decision to declare a patent null and void shall be registered and publicized by the Patent Bureau.

Article 50: A patent declared null and void is deemed nonexistent from the very beginning.

Chapter VI: Compulsory License for Using Patents

Article 51: A patent holder is obliged to manufacture his patented product or use his patented means in China, or permit other people to manufacture his patented product or use his patented means in China.

Article 52: If, after 3 years since the granting of a patent, a holder of a patent of an invention or practical new model fails to honor the obligations stipulated in Article 51 without a legitimate reason, the Patent Bureau may, in accordance with the request submitted by a unit capable of using the patent, grant a compulsory license to it.

Article 53: If a patented invention or a practical new model is technologically more advanced than a preceding one, and if its implementation is also based on the older one, the Patent Bureau may, in accordance with the request submitted by an applicant for the new patent, grant him a compulsory license to use the preceding invention or the preceding model.

By this same token of granting a compulsory license, the Patent Bureau may also grant a compulsory license for a newer invention or newer model in accordance with the request of the holder of the older patent.

Article 54: A unit or an individual applying for a compulsory license in accordance with this law must provide proof that a contract of using the license cannot be signed with the patent holder under rational terms.

Article 55: The Patent Bureau shall register and publicize its decision on granting a compulsory license.

Article 56: A unit or an individual having acquired a compulsory license should not monopolize the right of using it, nor is it empowered to authorize others to use it.

Article 57: A unit or an individual having acquired a compulsory license must pay a reasonable sum to the patent holder for using his patent, and the sum shall be negotiated by both parties; the Patent Bureau will arbitrate if an agreement cannot be reached.

Article 58: A patent holder who disagrees with the Patent Bureau's decision on granting a compulsory license, or its arbitration on setting the sum for the use of a compulsory license, may file a complain with the people's court within 3 months after notification.

Chapter VII: Protection of Patent Rights

Article 59: The scope of the patent rights protection for inventions and practical new models is based on the claim of rights. The manual and its attached diagrams may be used to explain the claim of rights. The scope of the patent rights protection for an exterior design is based on the product with the patented exterior design shown in a diagram or photograph.

Article 60: The patentee or any interested party may request the patent administrative organ to deal with any action that infringes upon the patent rights without the knowledge of the patentee, and may also directly file a lawsuit with the People's Court. In handling a case, the patent administrative organ is authorized to instruct the patent violator to stop his action and pay for the losses. If the litigant refuses to accept the ruling, he may file a complaint with the People's Court within 3 months after being notified. In dealing with those who neither file a complaint before the deadline nor follow the ruling, the patent administrative organ may request the People's Court to enforce the ruling.

When a dispute concerning a patent violation arises and if the invention patent covers a manufacturing method for a product, the unit or individual that manufactures the same type of product should submit proof of the manufacturing method for its or his product.

Article 61: The time limit for filing a lawsuit for a patent violation is 2 years from the date on which the patentee or the interested party knows or ought to know about this patent violation.

Article 62: The following situations are not considered to be patent violations:

1. The use or sale of a patented product manufactured by the patentee or manufactured with the permission of the patentee;

2. The use and sale of a patented product by someone who does not know that it is manufactured or sold without the permission of the patentee;

3. The manufacture of a product or the use of a method similar to a patented product or method before the date on which the patent application is filed, or necessary preparations have already been made for the manufacture of such product or the use of such a method before that date, provided that such product will be manufactured or such method used continually as originally intended;

4. The use of a patent by a means of transportation of a foreign country in its own facilities or equipment, when it passes through China's territorial land, waters and air for a short period, according to an agreement signed between China and that foreign country or an international treaty of which both China and that country are signatories, or according to the principle of reciprocity;

5. The use of a patent only for scientific research projects and experiments.

Article 63: Any person who imitates another person's patent will be dealt with according to Article 60 of this law. In dealing with those who are involved in serious offenses or are held directly responsible for the violation, it is necessary to pursue their criminal liability in accordance with Article 127 of the Criminal Law.

Article 64: For those who apply foreign patents without authorization and give away important state secrets in violation of Article 20 of this law, the unit where they work or the responsible organ at the higher level should call them to account administratively. Action will be taken according to law to pursue the criminal liability of those who are involved in serious cases.

Article 65: Administrative disciplinary action will be taken against those who infringe upon the patent rights of inventors or designers for their nonjob-related inventions and creations and other rights and interests stipulated in this law by the unit where they work or the responsible organ at the higher level.

Article 66: Administrative disciplinary action will be taken against the staff members of the Patent Bureau and state functionaries who practice favoritism or irregularities by the Patent Bureau or the responsible organ concerned. Action will be taken in accordance with Article 188 of the Criminal Law against those who are involved in serious offenses, for their criminal liability.

Chapter VIII: Supplementary Provisions

Article 67: A fee must be paid in accordance with regulations in applying patents or going through other formalities.

Article 68: Rules for implementing this law shall be formulated by the Patent Bureau and put into effect after being approved by the State Council.

Article 69: This law shall go into effect as of 1 April 1985.

Appendix: The related articles of the "Criminal Law" quoted by the "Patent Law" are as follows:

Article 127: In any case in which any industrial or commercial enterprise violates the trademark control rules and falsely uses any trademark registered by another industrial or commercial enterprise, the person who holds direct responsibility shall be sentenced to imprisonment for not more than 3 years, penal servitude, or a fine.

Article 186: Any state official who divulges an important state secret in violation of the state security rules shall be sentenced to imprisonment for not more than 7 years, penal servitude, or deprivation of political rights if the circumstances are serious.

Any person who is not a state official and commits the crime mentioned in the last paragraph shall be punished according to the provisions in the last paragraph, but consideration shall be given to the circumstances.

Article 188: Any judicial official who practices favoritism and irregularities and causes another person to be prosecuted whom he fully knows is innocent, or intentionally covers up for another person and allows him to avoid prosecution when he fully knows that person is guilty of the offense, or intentionally confuses right and wrong and gives a decision that perverts the law, shall be sentenced to imprisonment for not more than 5 years, penal servitude, or deprivation of political rights. If the offenses are particularly serious, he shall be sentenced to imprisonment for not less than 5 years.

CSO: 4008/190

NATIONAL DEVELOPMENTS

PATENT BUREAU DIRECTOR DISCUSSES USES OF NEW PATENT SYSTEM

HK080526 Beijing JINGJI RIBAO in Chinese 3 Mar 84 p 3

[Article by Huang Kunyi, [director of the State Patent Bureau: "Revitalize the Creative Spirit of the Chinese Nation"]

[Text] The Chinese nation has always been well-known to the world for the diligence, courage and wisdom of its people. Over a few thousand years, the Chinese people have created many things and had many inventions in astronomy, mathematics, geography, medicine, textiles, architecture and many other fields. Since the founding of new China, the creative spirit of the Chinese people, which was repressed, has once again been brought into play. Under the ideological guidance of patriotism and communism, the broad masses of workers, peasants and science and technological workers who are working hard in all fields have made many important inventions, and have greatly changed the seriously backward features of our country in science and technology. Having repeatedly weighed the advantages and disadvantages from an over-all view on development, we believe it is necessary for our country to set up a patent system to suit the needs of the new situation in socialist modernization. At present, the patent bill is being examined and discussed by the NPC Standing Committee, and the country will soon have a specific law on protecting and encouraging the creations and inventions of the Chinese people. Needless to say, it will be a matter of far-reaching significance in revitalizing the creative spirit of the Chinese nation.

The patent system has had a history of over three centuries in the world, and the fact that it is synchronous with the history of the development of modern science and technology is by no means a coincidence. It shows that the patent system is closely related to the development of modern science and technology. At present, there has arisen a new technological revolution in the world, with more and more inventions and creations in the three fields of information, life and material things appearing with each passing day. The formulation and implementation of the patent law in our country at this very moment will be advantageeous to mobilizing the broad masses to enthusiastically begin inventions and creations, and to catch up with the pace of the development of the world's science and technology. The existence of a patent system will give protection to whatever inventions and creations conform to the requirements of the patent, law, disregarding nationality, sex, profession, experience, educational background, or the nature of the ownership of an example of an invention.

The patent system will protect the product of the inventors, and at the same time, will require publicizing to the world the essence of what has been created and invented. This will be favorable to promoting the exchange of information on inventions, and the spread of new technology. The development of modern science and technology. In the development of modern science and technology. In the development of modern science and technology, without the exchange of information, it would be very difficult to promptly learn what new inventions and creations have appeared within a city, province, or country, to say nothing of the world. The isolation of information is like a wall that stands between scientific research and production, and the spread and application of new technology will naturally be slowed down. Development in the exchange of information on inventions will also be helpful to mutual enlightenment and the making of renovated inventions, while avoiding blindness in, and repetition of scientific research work.

Under the protection of the patent law, a product will receive a patent provided that it passes the examination of the patent bureau, and the transfer of technology with compensation within a fixed period of time is permissible. The inventor may get a certain amount as a reward from the compensation of technology transfer, which is advantageous to encouraging initiative in invention and creation, and follows the principle of "distribution according to work." If technology transfer with compensation is carried out in scientific research units, it may promote the economic accounting of scientific research work, encouraging it to efficiently serve economic construction. This will help scientific research work to be effectively circulated. The founding of the patent system will be helpful to the import of technology in foreign trade technology, while the transfer of inventions and creations from our country to foreign countries will also be protected; this is because the transfer of modern science and technology can hardly be independent of the impact of its value. The patent system is precisely produced and developed under the historical condition that technological invention has become a means of wealth and is considered a commodity, and even an international commodity. International protection is often mutual and on a reciprocal basis. There would be many obstructions without setting up the patent system under the condition of implementing the policy of opening up to the world and developing international economic and technological exchange.

The patent system will be implemented with the patent law as its core. The patent law of our country is to protect and encourage the initiative of the 1 billion people of our country to invent and create, and it is drawn up to suit the needs of the socialist modernization of our country. The establishment and application of the patent system is a new undertaking on our country. When the patent law is made known to the public, specific regulations will be drawn up for its implementation, special people be trained, knowledge of the patent system will be spread, and it will necessarily go through a process of gradual perfection. However, it is our belief that with the publication of the patent law and with the development of the building of spiritual civilization using education in patriotism and communism as the base, the fine sons and daughters of the Chinese nation will greatly invigorate their creative spirit, and achieve still more brilliant feats in revitalizing the Chinese nation.

CSO: 4008/174

STATE SCIENCE COMMISSION AWARDS 60 INVENTIONS

OW211249 Beijing XINHUA in English 1149 GMT 21 Jun 84

[Text] Beijing, 21 Jun (XINHUA)--The State Science and Technology Commission has decided to give national awards to 60 new inventions, two first-class, four second, 34 third and 20 fourth.

The six-day meeting of the commission's recommendation and examination committee for inventions closed here today.

The first-class winners were a welding arc adaptive control system and a new fine strain of corn called "Zhongdan No 2."

Developed by a research group headed by Professor Pan Jiluan of Qinghua University, the welding system automatically controls the arc according to the speed of intake of the electrode and smoothness of the workpiece so as to produce optimum welding parameters, greatly reducing sparks and raising the quality of the weld bead. This is a revolution in the traditional human control method used since the welding arc was invented 100 years ago.

The system also accurately controls the energy of the arc, making possible highly-efficient one-side welding with back bead formation. This provides a new way to improve the quality of welded low-alloy high-intensity steel products and pressurized containers.

Used with welding robots, the system will boost automation in the welding industry. It is designed for use in the machine-building, chemical, petroleum, marine, shipbuilding, spaceflight, aviation, nuclear energy and other industries.

The new corn strain was developed by Li Jingxiong of the Chinese Academy of Agricultural Science by combining nuclear radiation and hybridization. It is resistant to leaf blight, leaf spot and head smut, three common diseases which cannot be controlled by any chemical so far. On the average, the diseases cause a loss of half a million tons of corn a year in China, for their incidence in ordinary corn strains is generally more than 10 percent, as against two percent in the new strain. Per-hectare output of the new strain is 15 to 20 percent, or 0.75 tons, greater than that of ordinary strains.

The total growing area of the new strain from 1977 to 1983 has reached 6.3 million hectares. An additional 4.7 million tons of corn has been harvested. Since 1982, the strain has been the most popular corn strain in China.

Addressing the closing ceremony of the meeting, Wu Heng, chairman of the recommendation and examination committee, said that the sixty new inventions had brought in more than 900 million yuan (about 410 million U.S. dollars) so far.

CSO: 4010/3

INDIVIDUALS, UNITS RUN TECHNOLOGY CENTERS

OW261216 Beijing XINHUA in English 1206 GMT 26 Jul 84

[Text] Beijing, 26 Jul (XINHUA)--The first 11 science and technology centers run by individuals and collectives have been set up in Beijing to help promote the latest technological developments.

Supplementing those run by the government, these centers aid industrial enterprises and are supported by local government.

The Huaxia technology development center, the first to be established in April last year, forwarded technology for making ground cable power leakage monitors to the Liaoyuan Radio Factory in northeast China and drew an agreed commission on the factory's profit of 600,000 yuan (about 260,000 U.S. dollars) in the past year.

Among 14 other items supplied by Huaxia were a steady flow power source, a combustible gas meter, and an automatic digital rainfall recorder.

The center has also entered into cooperation with firms in the United States, Western Europe, Hong Kong and Macao.

The center was launched by Chen Chunxian, a research fellow at the Institute of Physics of the Chinese Academy of Sciences, with a 100,000-yuan (about 43,000 U.S. dollars) loan from a local industrial company.

Chen's center now has some 70 staff members, including two engineers from the Institute of Physics, and dozens of paid spare-time technicians.

The ten other centers offer services in computing technology.

These centers contribute to the interflow of technical personnel and have opened a new channel for scientific research, says the Beijing Association for Science and Technology.

A federation will be set up to pool their experience, the association says.

CSO: 4010/3

SCIENCE ACADEMY PRESIDENT ON FUTURE TASKS

OW281351 Beijing XINHUA in English 1256 GMT 28 May 84

[Text] Beijing, 28 May (XINHUA)--Professor Lu Jiaxi today announced that the Chinese Academy of Sciences plans to set up a number of laboratories this year and next and open them to visiting Chinese and foreign scientists.

In an interview with Chinese and foreign journalists, the academy president expected the move to enliven academic exchange and raise scientific levels. Symposiums will be organized on the basis of special research projects undertaken in the open laboratories.

Lu Jiaxi, 68, a chemical physicist of Taiwan origin, is concurrently director of the Fujian Institute of Research on the Structure of Matter. He said that his institute is already ahead of the academy in opening its doors to visitors by cooperating with U.S. scientists in a number of research projects.

As the president of the academy, Professor Lu said, he feels a sense of urgency in trying to make the academy's research and development serve the country's economic construction in the remaining years of this century.

He said that his academy also needs reforms. The egalitarian practice should be discarded and staff members not fit for research work should be transferred. Research institutes should also adopt the responsibility system which clearly defines their functions and powers. Mobility of research personnel should be permitted within reasonable limits.

He believed that the best way to use middle-aged and young scientists is to assign them to research projects rather than to burden them with administrative responsibilities.

Professor Lu said the Chinese Academy of Sciences, which has a graduate school offering master's and doctoral degrees, will also offer post-doctoral projects.

Among those appearing at the same press conference was Qian Weichang, professor of mechanics and president of the Shanghai Industrial University. He disclosed that he and his colleagues are starting a program for financing more than 200 young people studying abroad each year.

He explained that the government student exchange program still falls short of the needs. He added that the candidates, who must be holders of the masters degree, will spend four years studying for the doctorate.

CSO: 4010/3

PRC URGES RESTRUCTURING OF TECHNOLOGY RELATIONS

OW191956 Beijing XINHUA in English 1504 GMT 19 Apr 84

[Text] Tokyo, 19 Apr (XINHUA)--China today called for a restructuring of the existing unfair international science and technology relations and urged the developed countries to make due contribution to it.

Speaking on the subject of technology for development at the 40th session of the UN Economic and Social Commission for Asia and the Pacific (ESCAP) here today, Vice-Chairman Xie Qimei of the Chinese delegation, said that the solution of the pressing problems facing developing countries should be correctly integrated with the long-term goal of establishing a new international economic order.

To restructure the unfair international relations in the field of science and technology, he said, constitutes an important aspect of the effort to realize that long-term goal.

He said that many ESCAP countries, though having played an important role in the history of human civilization, are increasingly lagging behind in science and technological field because of historical reasons.

He hoped that developed countries will show positive political will and make contribution to a rational solution of the urgent issues facing the developing countries which, he said, include technology transfer, financial assistance for technical development and control of brain drain.

However, he stressed that the ultimate objective of expansion of international cooperation in science and technology should be the enhancement of the levels of the nation's science and technologies and the strengthening of capabilities of self-reliance, rather than sheer dependence of foreign technology or the weakening of the ability to develop the nation's science and technology.

The Chinese Government, he said, always attaches great importance to technical cooperation and exchanges among developing countries in the belief that such cooperation and exchanges provide an important means to promote learning from each other, mutual assistance and common progress. "We ESCAP developing countries have common interests in promoting science and technology for socio-economic development," he said.

Referring to the principles of "equality and mutual benefit, stress on practical results, diversification in form and achievement of common progress" that was proposed by Chinese Premier Zhao Ziyang during his African tour last year, Xie said these principles are also applicable to China's technical cooperation with ESCAP developing countries.

Noting that all countries and nations have their own strong points and specialities, Xie said the exchange of experience and furtherance of cooperation to make up each other's deficiencies is indispensable to promoting scientific and technological development and economic growth of all countries.

In a reference to the agreements on 32 projects of cooperation reached last November in Beijing during the intergovernmental consultation on technical cooperation among developing countries (TCDC) jointly sponsored by ESCAP and the Chinese Government, he reaffirmed China's pledge to continue joining efforts with the countries concerned to bring these projects to fruition.

To conclude his speech, Xie gave a brief account of China's strategy in gearing science and technology to development.

CSO: 4010/3

LEGAL EXPERT URGES PROTECTION FOR FOREIGN TECHNICIANS

OW081144 Beijing XINHUA in English 1058 GMT 8 Aug 84

[Text] Beijing, 8 Aug (XINHUA)--An international law researcher here suggested that legislative measures be taken to promote technical personnel exchanges with foreign countries.

Deng Zhenglai, an international private law graduate student of the Beijing Foreign Affairs College, made the suggestion recently in an article that China take legislative measures to protect the legitimate rights of foreign scholars and experts in their activities giving technical guidance and know-how to help China's modernization efforts.

Deng is one of China's up-and-coming young law researchers. His suggestion has been supported by some noted Chinese law experts including Li Haopei, veteran legal advisor to the Ministry of Foreign Affairs.

Deng's article dealing with the relations between the new world technology revolution and international private law was carried in the latest issue of LEGAL SCIENCE magazine.

Deng said that in the worldwide new technology revolution, China mainly employs two ways to import foreign advanced techniques, namely, direct import of foreign advanced techniques and import of technical guidance and technical know-how through exchanges with foreign technical personnel. So far, Deng said, China has had no special regulations governing the latter method.

Legislation in this regard, Deng added, would clear the doubts of those foreign experts who come to China, and would be beneficial to China's efforts to learn advanced foreign techniques.

Historical development shows that a legislative system reflects the needs of scientific and technical development, while scientific development will in turn promote the improvement of the legal system as a whole, Deng said.

Along with China's policy of opening to the outside world, there have been increasing foreign economic activities which have made necessary certain changes in civil legal relations involving foreign countries. Therefore, it is necessary to promulgate as soon as possible a business law governing internal and external legal relations of companies and enterprises, and providing a legal guarantee of their legitimate rights and interests as a base for solving legal issues.

In his article, Deng also suggests specific regulations on information to protect its supply, exchange and purchase.

CSO: 4010/3

SHANDONG SCIENTIFIC WORK MEETING ENDS

SK010924 Jinan Shandong Provincial Service in Mandarin 2300 GMT 31 Aug 84

[Excerpts] After a 7-day session, the provincial scientific and technological work conference sponsored by the provincial CPC committee and the provincial people's government, successfully concluded in Jinan City on the afternoon of 31 August. The conference emphatically pointed out that efforts should be made to follow the spirit of conducting reforms in accelerating the pace of progress in science and technology.

Ma Changgui, vice governor of the province, presided over the conference. Lu Maozeng, deputy secretary of the provincial CPC committee, addressed the conference.

During the conference, participating comrades earnestly studied the important directives given by leading comrades of the central authorities in regard to scientific and technological work and the documents adopted at the national scientific and technological conference. They heard and discussed the important report of Governor Liang Buting and heard the special reports of the six departments, including the provincial Planning Commission, and the report of the seven units, including the Weifang City People's Government, on introducing their model experience gained in scientific and technological work. They also concentrated on studying measures for further implementing the central authorities' strategic principle and policy decision of relying on science and technology in economic construction and focusing scientific and technological work on economic construction. Through studies and discussions, participating comrades have further upgraded their understanding, defined their duties, discerned the direction of reform, strengthened their sense of responsibility and emergency in focusing their work on economic construction, and have enhanced their confidence in creating a new situation in scientific and technological work.

The conference urged various localities and units to further upgrade their understanding and to realistically integrate the guiding ideology of economic, scientific, and technological work with the central authorities' strategic principle. To this end, the conference put forward the following tasks:

1. Efforts should be made to adopt a strategic viewpoint in discerning the strategic target and task faced by the economic, scientific, and technological work in realizing economic development;

2. Efforts should be made to adopt an overall viewpoint in profoundly understanding and totally implementing the central authorities' principle of relying on science and technology in economic construction and focusing scientific and technological work on economic construction; and

3. Efforts should be made to adopt a viewpoint of practice in turning the central authorities' principle into actual deeds so as to guide the practice of scientific and technological work.

It is necessary to further emancipate minds and to accelerate the pace of conducting reforms in scientific and technological work. At present, efforts should be made to further eliminate leftist influence ideologically, to thoroughly negate the Great Cultural Revolution, to root out factionalism, to strengthen party spirit, to enhance unity, and to boldly create something new so as to bring into full play the enthusiasm and creativeness of the broad masses of scientific and technological personnel. We should vigorously organize all forces to do a good job in mapping out long-term plans for developing science and technology and to make all-out efforts to successfully grasp development and research in productive technology, to popularize the results of scientific and technological research, and to conduct various scientific and technological work so as to further enliven the province's scientific and technological undertakings, to vitalize the economy, and to accelerate the pace of building modernization.

CSO: 4008/1

ZHEJIANG SUCCESSES IN SCIENTIFIC DEVELOPMENT

OW061323 Hangzhou Zhejiang Provincial Service in Mandarin 1030 GMT 2 Sep 84

[Text] In the past 35 years, Zhejiang Province, where there were only 2 agro-technical institutes staffed by 71 scientists and technicians before liberation, has built 384 scientific research institutes of various kinds equipped with more than 400 sets of precision instruments under the unified management of the State Scientific and Technological Commission. Thus, a powerful scientific and technological contingent has been built in the province. The province now has more than 7,800 scientists and technicians, 100 times the number before liberation.

The broad masses of scientists and technicians have worked hard as masters of the country. They have made outstanding contributions in tackling key difficult scientific problems, spreading scientific knowledge, introducing technology from abroad, and popularizing the application of scientific and technological achievements.

In the past 35 years, 4,815 scientific and technological achievements have been scored in the province, and 2,734 of them have been made since the 3d Plenary Session of the 11th CPC Central Committee. Of these achievements, 19 were awarded state invention prizes, and 235 were awarded prizes by the national science conference.

(Yuanfengzhao), a new variety of early rice bred in the province, has achieved remarkable economic results after being popularized. It has become the main variety of early rice planted in provinces south of Chang Jiang. This variety was awarded a state invention prize, first class, in 1983.

Working hard to meet the requirements of economic construction, comrades on the province's scientific and technological front are confidently taking up challenges of the new technological revolution.

CSO: 4008/1

LIANG BUTING'S SCIENTIFIC WORK REPORT

SK270521 Jinan Shandong Provincial Service in Mandarin 2300 GMT 25 Aug 84

[Text] In his report delivered at the provincial scientific and technological work conference held on the morning of 25 August, Liang Buting, secretary of the provincial CPC Committee and governor of the province, stressed that efforts should be made to rely on making progress in science and technology to enliven the province's economy.

After analyzing and summing up the new achievements scored by the provincial scientific and technological front since the 3d Plenary Session of the 11th CPC Central Committee, Comrade Liang Buting stated: The CPC Central Committee and the State Council have scientifically summed up the historical experience gained in the economy and social development, and have accurately mapped out the strategic guideline of relying on science and technology in economic construction and of focusing science and technology on economic construction. The guideline has thoroughly brought to light the dialectical relationship between economic construction and science and technology and has defined the strategic position of science and technology in the program of building the four modernizations. The program will come to nothing without the support of science and technology that will derail from their track if they do not concentrate on serving the program. We must deeply understand the guiding ideology set forth by the central authorities, get a clear understanding of the situation, upgrade our consciousness, truly regard the crucial task of modernizing science and technology to emphasize the strategy, and must uphold the spirit of racing against time in rapidly pushing forward the province's scientific and technological work.

Comrade Liang Buting stated: In developing science and technology, we must unswervingly implement the principle of having science and technology serve economic construction, focus our research on the program of building the four modernizations, conduct our research work in line with world standards and in a long-term manner, uphold the principle of taking the research of application and development as a main task and paying simultaneous attention to both research and populatization, and must do a good job in dealing with the relationship between technical import and creating something new after digesting what one has learned from the imported technology. By proceeding from the demand set forth by the strategy and existing conditions, we should concentrate our efforts on research or on mastering a number of crucial subjects that have a vital bearing on economic results and should form the new, advanced, and available

results and technology into a complete set and widely popularize them. Efforts should be made to accelerate the pace of utilizing outside capital and introducing advanced technology so as to ensure the prefulfilling by 1 year of the task of doubling the total industrial and agricultural output value by the end of 1980's, and so as to lay a solid and reliable foundation for the future economic leap forward.

Comrade Liang Buting stated: The task we face is very arduous, which requires leading personnel at all levels and various industries and trades, particularly the broad masses of staff members and workers on the scientific and technological front, to make concerted efforts to fulfill the task. To this end, it seems that we should do a good job in grasping the following works:

1. Efforts should be made to strengthen the strategic research of the province's economic, social, scientific and technological development and to concentrate on mapping out plans of scientific and technological development for the Seventh 5-Year Plan and the 1990's.

2. Efforts should be made to realistically improve the conditions of scientific research and to earnestly do a good job in setting up scientific and technological methods.

3. Efforts should be made to formulate the policy on supporting the popularization and application of scientific and technological results and award measures, and to establish or improve the system of popularizing and applying scientific and technological results.

4. Efforts should be made to accelerate the pace of building the system of exchanging scientific and technological information.

5. Efforts should be made to strengthen the work of introducing outside advanced technology.

Comrade Liang Buting pointed out: The current urgent task to create a new situation in the province's scientific and technological work calls for conducting reforms among the existing managerial systems of science and technology. For many years, we have basically set up our scientific research units with a subordinate relationship to administration. Thus, one of the prominent malpractices cropping up in existing scientific and technological systems is the lack of a link between scientific research units and enterprises and the disjointedness between science and technology and the economy. The overwhelming majority of scientific research units depend totally on state funds in carrying out their work. Therefore, they often harbor the idea of an iron rice bowl in research expenses and of eating from the same big pot in engaging in research work regardless of whether one has done a good job or a bad one. The scientific research units are not responsible to the economy and are short in motive power, vigor, and an urgent sense of serving the economy. The ownership of scientific

research units by departments and localities has become serious and research forces are dispersed by duplication of units and research subjects. All of this has brought about a great waste of manpower and material resources. Some scientific research units have not made achievements over the past several years because of weak leading forces, irrational personnel structures, and chaotic managements. Such a situation has become more and more unsuitable to the task imposed on the scientific and technological front.

At present, the transformation drive in rural areas is being continuously deepened and the drive in urban areas is being carried out step by step. The voices of scientific and technological personnel are raised high in asking for transformations. Under these circumstances, it is imperative to conduct reforms among scientific and technological systems. Mistakes are allowed in conducting reform, but it is not allowed to fail to conduct reform out of a fear of making mistakes. Still, we will not allow anyone to attempt to block the transformation drive on any pretext. The broad masses of cadres and workers throughout the province on the scientific and technological front should try their best to bring their intelligence and wisdom into full play and to make concerted efforts to do a good job in conducting reform in science and technology.

Comrade Liang Buting emphatically pointed out: The top priority task in pushing forward science and technology and economic construction is the further implementation of the policy on intellectuals and effectively bringing into play the enthusiasm of scientific and technological personnel. The key to implementing the policy on intellectuals in an overall way and bringing into full play the enthusiasm of scientific and technological personnel lies in eliminating leftist influence and doing away with various out-of-date ideas, and in upgrading the understanding of leading personnel at all levels on the importance of talented people. In implementing the policy on intellectuals in an overall way and bringing into full play the enthusiasm of scientific technological personnel, we should wholeheartedly help them solve their practical problems. It is most important for us to employ talented personnel in a rational way. In order to do a good job in conducting unified management over scientific and technological cadres and in organizing rational transfer, the provincial authorities decided to establish a bureau to be in charge of the affairs of scientific and technological personnel.

In conclusion, Comrade Liang Buting emphatically stated: The key to success in conducting scientific and technological work lies with the party committees and governments at all levels strengthening their leadership over the work. The way to strengthen leadership over the work may be summarized as follows:

1. Efforts should be made to bring into play the enthusiasm of scientific and technological personnel,

2. Efforts should be made to impose concrete tasks on the scientific and technological front,

3. Efforts should be made to create conditions for scientific and technological work, and

4. Efforts should be made to pave a way to put scientific research results into production.

Success or failure in fulfilling the four above-mentioned tasks can be regarded as the yardstick for measuring the achievements of the leadership in conducting scientific and technological work.

CSO: 4008/1

GUANGDONG DEVELOPS EXCHANGES WITH FOREIGN COUNTRIES

HK130850 Guangzhou Guangdong Provincial Service in Mandarin 0400 GMT 13 Sep 84

[Text] Guangdong's scientific and technological exchanges with foreign countries are becoming increasingly brisk. According to incomplete statistics from the provincial and city commissions for science and technology, since the 3d Plenary Session of the 11th CPC Central Committee, our province has conducted more than 800 scientific and technological exchanges with more than 20 countries and regions. In the meantime, our province has imported more than 100,000 sets of technological equipment and signed more than 30,000 technological and economic contracts with the use of foreign funds.

In recent years, our province has imported a number of advanced technologies and equipment by various means, such as asking experts and professors from foreign countries or from Hong Kong and Macao to give lectures and running various professional training classes and holding scientific and technological exhibitions or forums in conjunction with foreign businessmen. For example, the application of computers in our province has been developed by asking experts to give lectures and to run computer training classes. At present, computers have been applied in more than 20 trades and professions, more than 130 enterprises, and a number of management departments and institutions in our province.

CSO: 4008/1

QIAN XUESEN DISCUSSES TECHNOLOGICAL REVOLUTION

HK230700 Shanghai SHIJIE JINGJI DAOBAO in Chinese 2 Apr 84 p 3

[Article by Qian Xuesen: "Certain Basic Problems Concerning Understanding the New Technological Revolution"—Part I]

[Text] Editor's note: We must study and create the science of socialist modernization, which is actually the theory of the management of the entire country as well as the theoretical basis of social systems engineering or social engineering. This subject also concerns the application of systems science and systems engineering to the work of overall organization and management of the country. [end editor's note]

I. Scientific Revolutions, Technological Revolutions, and Social Revolutions

The question we are going to discuss actually concerns the laws of development of man's social activities. Nothing in the world ever develops smoothly and steadily, but invariably follows a tortuous path. At various times there may be advances, stagnation, or leaps. A leap is a revolution. I wish to expound on this question from four aspects. I will first discuss three aspects.

The first aspect concerns leaps in man's understanding of the objective world. These can be called scientific revolutions. "Scientific revolution" is a term used by an American philosopher of science, Thomas Kuhn. He wrote the book "The Structure of Scientific Revolutions." His book contains some idealist viewpoints that we cannot accept. However, he holds that man's understanding of the objective world does not develop smoothly and steadily, and sometimes revolutions may occur. The concept of scientific revolution is compatible with Marxist philosophy.

In this connection, what scientific revolutions have occurred in the history of science? What developments were leaps in man's understanding of the objective world? For example, during the 16th century the heliocentric theory, which states that the earth revolves round the sun, appeared in Western countries. At that time this was a leap in man's understanding of the objective world. The appearance of Newtonian mechanics in the 17th century was another scientific revolution in man's understanding of the objective world. The discovery of oxygen in the latter half of the 18th century was another leap in man's understanding of the objective world. In the 19th century, there were three epoch-making scientific discoveries; namely, discovery of the cell, the transformation

of energy, and the evolution of living organisms. Engels considered them epoch-making scientific discoveries. Scientific revolutions also took place in the realm of social sciences, and there were two revolutions of this kind in the mid-19th century, both of which were imitated and caused to develop by Marx. The first one was the proposal and founding of historical materialism by Marx. This was a scientific revolution. Soon afterward, Marx advanced the surplus value theory. This was also a scientific revolution. Both of these revolutions were leaps in man's understanding of his own society. Later, the electromagnetic field theory appeared, which integrated electricity with magnetism. In the early 20th century there was an even larger number of discoveries, for example, Pavlov's discoveries in psychology, the relativity theory, quantum mechanics, and so on. At present, a scientific revolution in quantum field theory is probably brewing. This theory attempts to unify the roles of four categories of forces in physics. These are the gravitational force, which is weakest, as well as weak interaction, electromagnetic interaction, and strong interaction. These four kinds of interactions must be unified, and a general and unified field theory must be established. At present this task has not been accomplished. Its accomplishment will certainly be a scientific revolution. I wish to demonstrate through these examples that scientific revolutions are leaps in man's understanding of the objective world.

The second aspect concerns the question of man acquiring an understanding of the objective world in order to transform the objective world. Do leaps occur in man's transformation of the technology existing in the objective world? The answer is, of course, affirmative. This kind of leap is a technological revolution. The term technological revolution was used at a very early time by Comrade Mao Zedong. In his comments and instructions, written in a document in 1969, he very clearly stated that ordinary and minor technological improvements can be called technological innovations, while major and basic technological changes that have extensive effects are called technological revolutions. Comrade Mao Zedong not only suggested this term, but also gave three examples of technological revolutions: the appearance of the steam engine, the appearance of electric power, and the appearance of atomic energy (which we now call nuclear energy) in today's world. Thus, the meaning of technological revolution has been very precisely set.

In light of this meaning, we can also trace other technological revolutions in history. In ancient times man began to learn how to use stone tools. At that time, the making of stone tools was an extraordinary major achievement in man's transformation of the objective world. It was a technological revolution in history. The use of fire can also be said to be a technological revolution. In modern times, leaps in man's transformation of science and technology in the objective world include the appearance of the steam engine, the diesel engine, chemical engineering technology, electric power, radio technology, and aeronautics technology. At present there are new technological revolutions that we frequently talk about, for example, those involving computers, genetic engineering, laser technology, nuclear energy, nuclear technology, space technology, marine engineering, and so on. Therefore, there are a number of new technological revolutions, instead of a single one.

I think that the group of new technological revolutions probably should not only include the above items, but should also include systems engineering. This is because nowadays the organization and management of a complicated natural or artificial system, such as a factory, a project, or even something as large as a country, do not merely depend on thinking, envisioning, and conjecture, but must depend on quantitative scientific analysis. This represents an extraordinary change, which is the introduction of systems engineering. Therefore, the introduction of systems engineering should be regarded as a leap in man's transformation of the objective world, that is, a technological revolution.

A third kind of revolution is the leap in the realm of social systems, which we call social revolutions, or simply revolutions. For example, the collapse of the primitive communes and the birth of the slave system constituted a leap in the realm of social systems, or constituted a social revolution. Subsequent social revolutions or leaps in the realm of social systems included the transformation of the slave society into a feudal society and the transformation of the feudal social system into a capitalist social system. The establishment of the socialist and communist social system is, of course, a leap in the realm of social systems, or a social revolution.

II. Revolutions in Production

The term revolution in production [chanye geming 3934 2814 7245 0730] was used by Engels as early as 1845 in his book "The Condition of the Working Class in England." However, there is great confusion in the capitalist countries' use of the terms revolution in production [chanye geming], industrial revolution [gongye geming 1562 2814 7245 0730], and scientific and technological revolution. Under this condition, it would be fine if we were not to talk about revolution in production for the time being. However, we cannot evade this question because this term appears in the works of Engels and Marx. We should, according to the concepts of dialectical materialism and historical materialism, study what revolution in production is. Moreover, what the capitalist countries call revolution in production, "the fourth global revolution in production," "the third wave," and so on, also contain a hidden idea that we cannot agree to; that is: Marx theory, or Marxism, was derived through analysis based on the results of the first revolution in production, and this is the basis of your scientific socialism, but now, because a new revolution in production has appeared and because Marx, Engels, and Lenin naturally could not have seen this new revolution, their theories no longer hold. The criticism against us in that our communism and our scientific socialism have become something questionable. In his book, Toffler vigorously preaches that now that a new revolution in production, or "the third wave" has appeared, capitalism can be saved and the contradictions of capitalism can now be resolved. This kind of argument naturally aims to generate confusion, just as one tries to make water muddy by stirring the bottom. It is naturally groundless. We must solemnly analyze and refute it. I think we should aim to acquire a new understanding of the meaning of revolution in production.

To achieve this aim we must go back to Engel's book "The Condition of the Working Class in England." Engels wrote a great deal about the changes in industry, communications, transportation, and agriculture, which occurred in England over

a period of nearly 60 years from the end of the 18th century to the 19th century. He called these drastic changes a revolution in production. Engels' book enables us to understand that a revolution in production definitely does not mean a partial change and does not mean a leap arising from the application of production technology to a specific realm, but means some overall leaps and changes affecting the entire system of production. Changes occur not only in industry, agriculture, communications and transportation, but also in economic relations. Therefore, expressed in the form of a definition, a revolution in production consists of leaps and changes in the organizational structure of the production system and in economic structure. It consists of leaps that are caused by a development of the productive forces, which is in turn promoted by advances in production technology.

Is this definition applicable to the history of man's development? Are there other examples in human history? I think revolution in production did occur in ancient history. A revolution in production happened in the primitive commune period. The appearance of crop growing and animal husbandry greatly changed the production system whereby man made a living by relying solely on collecting or hunting for plant products or animal products in nature. Thus, man himself could control production, at least partially, resulting in a leap in the realm of the production system. Therefore, the appearance of agriculture was a revolution in production, probably the first of its kind in human history. The second revolution in production possibly happened in the slave society. For the first time, the production of commodities appeared; that is, production was carried out for the sake of exchange. This was also a leap in the realm of economic structure and in the organizational structure of the production system, and was consequently also a revolution in production. Therefore, the revolution in production that occurred between the end of the 18th century and the beginning of the 19th century was the third revolution in production in human society.

Can revolutions in production be distinguished from social revolutions? Are they different things? I think they can be distinguished from each other and they are different things. In the first place, past examples can enable us to understand this point. For example, Marx said that though the appearance of limited joint-stock companies under the capitalist system was a change in the form of production, this change was an instance of sublation within the scope of the capitalist mode of production itself and did not cause the capitalist system to change. Today, in capitalist countries, some workers hold one or more shares in some companies. However, the number of shares owned by workers is negligible, so that instead of exercising great control over the companies, the workers must obey the capitalists and must be exploited by them. Therefore, great changes or even leaps may occur in economic structure and in the organizational structure of the production system, leading to a revolution in production without any change in the social system.

On this question, things can be seen more clearly in our country. Considering our social system or our state system, after the transition period, and since the adoption of the first constitution of the PRC at the First Session of the First NPC convened in September 1954, our system has remained unchanged and we have always had a socialist system and a socialist state.

However, there have been many changes in the production relations and in the superstructure. First, the state system as one aspect of the superstructure has changed many times. Changes have accompanied each revision of the constitution. Our existing new constitution, drawn up in April 1982, represents a great advance compared with the old constitutions. Second, considering those reforms of the system of leading cadres of our party and our state which Comrade Deng Xiaoping put forth, are they not some major changes to come in the realms of production relations and superstucture? Third, do not both Comrade Hu Yaobang's report at the 12th CPC Congress and Comrade Zhao Ziyang's reports at the 4th Session of the 5th NPC and the 1st Session of the 6th NPC clearly set forth the guiding principles and tasks of reform as well as point out those aspects of the production relations and the superstructure which urgently need to be changed? Fourth, there have been heartening changes in our countryside over the past several years, which have been brought about by reforms in the production relations and the production system. Fifth, at present, in our country, there are national corporations such as the National Shipping Corporation, the National Petrochemical Corporation, the National Nonferrous Metals Corporation, and so on. Are these not economic entities which organize production on the basis of entire industries and which are similar in form to monopolist companies abroad? We can give many other examples of changes in production relations and in the superstructure, which take place under the precondition that the social system remains unchanged in our country. These changes incorporate changes in economic structure and in the organizational structure of the production system. Because changes and development will lead to leaps, revolutions in production will happen under the precondition that the social system remains unchanged.

Comrade Mao Zedong said at an early time that in socialist society, the contradiction between the production relations and the productive forces and that between the superstructure and the economic base continue to be the basic contradictions. Our productive forces must invariably continue to develop, and therefore the economic structure and the organizational structure of the production system must inevitably continue to develop, so that leaps or revolutions in production will occur.

We have described revolutions in production as leaps in the realm of economic structure and in the organizational structure of the production system, and we have distinguished them from social revolutions. Is this compatible with historical materialism? I think so, in light of the arguments given above. Moreover, the arguments above have also demonstrated that the two formulations used abroad--the so-called "industrial revolution" [gongye geming [1562 2814 7245 0730]] and the so-called "scientific and technological revolution"—are not precise. The first formulation, being limited to a narrow scope, is not comprehensive enough, while the second formulation, whose connotations are not clear, cannot be distinguished from the scientific and technological revolutions that we talk about. Our view is more profound and can more clearly explain the essence of the issues under consideration compared with some Western Economists' "long cycle theory" which is based on statistical data. However, we should continue to study hard, and we should particularly study the question of the interactions between scientific and technological revolutions, revolutions in production, and social revolutions.

CSO: 4008/1

SUGGESTIONS OFFERED TO IMPROVE MANAGEMENT OF SCIENTIFIC RESEARCH

Tianjin KEXUEXUE YU KEXUE JISHU GUANLI [SCIENTIOLOGY AND MANAGEMENT OF SCIENCE AND TECHNOLOGY] in Chinese No 4, 12 Apr 84 pp 32-33

[Article by Zhu Xinmin [4281 2450 3046] of the Anhui Branch, China Academy of Agricultural Sciences, editor Zhao Jian [6392 5329]: "Practice and Cognition of the Management of Scientific Research Institutes"]

[Text] Scientific research institutes in China are different from those abroad. The management of scientific research institutes should not merely use the experience of other countries for reference. We must combine their experience with the realities of China. Through practice and cognition, we can sum up and produce suitable management methods with distinctive Chinese features. The following paragraphs are merely based upon several years of observation and practice in agricultural, scientific research units. I offer a few commonplace remarks by way of introduction so that others will come up with valuable opinions.

At present, traditional methods are employed in the management of scientific research institutes, such as learning, administration, the economy, the legal system, and ideological education. From the vantage point of practice, the success of management lies in implementing a responsibility system based on the division of labor (the separation of authority system) under the guidance of a united ideology. Its basic characteristics are:

1. A Unified Guiding Ideology:

This guiding ideology can be divided into three levels. The top level are the positions, viewpoints and methods of Marxism, Leninism and Mao Zedong Thought. The middle level are the related guiding principles, policies and guiding documents of the party and government. The bottom level is to integrate the actual conditions of the unit with the instructions, plans, standards and norms for actions. The first two levels have a general character and are the guiding ideologies suited for larger spheres. The last level should be the guiding ideology which distinctively reflects the character of the unit. All three levels are criterion for unifying everyone's actions and ideological foundations. They are the soul of the whole scientific research institute.

2. A Pluralistic Work Structure:

Scientific research institutes are a small society, we need to set up various management organizations. There are generally three kinds of work groups in a scientific research institute. The first is the party organization work group. The second is the administrative work group, such as the institute affairs

committee. The third is the academic work group, such as the academic committee. The main tasks of the party organizations are to unify the guiding ideology of all the workers, and to ensure concerted action by means of party organizations, the party's Communist Youth League, party labor unions, and by means of enthusiasts who apply to join the party. Administrative work groups mainly strengthen the social and business administration aspects of management and service work by means of research laboratories and groups, as well as personnel, finance, accounting, welfare, security, and health organizations. They do this to set up a good social order and a good scientific research order to provide and create for scientific research workers conditions favorable for scientific research and work. The academic work group should keep in close touch with the research laboratory, with the task group and with academic leaders. It should conscientiously handle the choice of projects, authenticate the results, determine the title of positions, enliven the academic atmosphere, and encourage more science and technology results through science and technology activities such as academic exchanges. Leading cadres of the three work groups should closely coordinate, support and cooperate with each other.

3. A Network of Overlapping Functions.

Party, administrative and academic work groups should make everyone understand, accept and implement their decisions and activities. Each work group and its system should consider the decisions and activities of other groups when implementing their own, and enable them to be in an appropriate position and in a dynamic coordinated relationship with others. If this point is ignored, the network will be destroyed and the collective power will be weakened. Because of this, we must always promote within the network interaction, interchange, help each other forward and counteract each other's weaknesses. Under general circumstances, ideology is the foundation, learning is the center and administration is the guarantee. We alternately implement them with and without order, and with and without balance; this is dialectical unity. If we can recognize this point, we will turn from passive to active management, so that the functions of all work groups will be effectively woven into a whole. The vitality of management will be brought into full play, and the continuous development of scientific research will be ensured.

4. A Lively Work Situation.

This also reflects the superiority of the socialist social system. In scientific research institutes, although their jobs are different, leaders and followers, managers and the managed, high level scientific research workers, middle and low level scientific research workers, cadres, and workers are all equal as cadres in terms of interpersonal relations. They should care for, cherish and support each other. Debate and opposition are allowed during work discussions, because debate is usually the prelude to unity, and opposition can often be transformed into strong support. The key to this transformation depends upon the guidance techniques of the leaders. Even though we cannot immediately reach unanimity, it is not a bad thing because this can help leaders consider other factors and prevent onesidedness and subjectivity in policy making and implementation. At work, leaders encourage everyone to have the courage to practice and to take responsibility. Even though shortcomings and mistakes occur, it is not easy to deny these qualities. Doing this helps discover and temper talent.

5. Reach the Same Management Goal by Different Routes.

Whether in the management of party affairs, of administration or of learning, whether in service work, in scientific research work, in studying, on the job or in training, it does not matter what post one holds, nor what kinds of habits or character. Although everyone has his own needs and goals, he should tie them to the general goal. This means that everyone should directly or indirectly work hard to produce results and talent, and to do a good job of production and service.

The key to implementing the management of the system based on a division of authority under the guidance of a unified ideology is to have capable and coordinated leading groups. "Capable" means that the leading groups have to have knowledge of scientific research management. They have to be good at making decisions on specific management goals in order to choose appropriate management methods, in order to possess earnest, down-to-earth enthusiasm and a problem-defying spirit, they will be able to obtain good management results. "Coordination" not only means unity within the group, it also means being good at strengthening the unity of the whole institute, including the unity between upper and lower units, the unity between units at the same level and the unity among neighboring units. After acquiring a capable leading group, there should be practical laws and regulations as well. Organizations and the laws encourage and restrict each other. This means that we must establish a set of effective rules and regulations and through common practice gradually achieve the stage at which they become accepted. The two most important of these are a system of personal responsibility for all, and management standards. We should be in accord with standard requirements in setting up or in dismantling organizations, and in organizing management activities, scientific activities and service work. We cannot do as we please and go our own way. Standards have the function of guiding and restricting people within a relevant framework. In matters that are clearly encompassed by standards, workers and scientific research workers can follow the standard requirements to carry out their work and to develop their activities without asking for instructions or without submitting reports. It is inadvisable for leaders and managers to interfere. They should take the lead in conscientiously following the standards. Once the standards are determined, extensive publicity should be given to them and they should be strictly implemented. They should be used as teaching material when training workers. All workers should undergo training; we have to first train all present workers in turn. Second, we have to train new workers. New workers can officially work after they have become familiar with the standards because the old workers have helped train them. From the viewpoint of present realities, this is a very pressing and important job.

China is a developing socialist country and is unlike developed countries where society-run scientific research is highly socialized and specialized. In our country, scientific research runs society. The scope of management is wide; there are too many things to attend to. Management organs are big. People in management generally never have gone through special training, management methods are mostly traditional; some leaders rely solely on their own experiences. Therefore, the organizational setup and management methods are different in various areas. Cases like these are numerous, they create problems and cause confusion in the selection of research projects, appraisals of and rewards for results, as well

as in the evaluation of technical titles. In order to overcome this confusion as soon as possible, and to effectively improve the management work of scientific research institutes, concerned departments should unify organizations, sum up experiences, formulate standards, develop training, and as soon as possible make scientific research management more scientific. This is very important work to reform the management of scientific research.

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BENEFITS OF CONTRACT SYSTEM FOR SCIENCE, TECHNOLOGY DISCUSSED

Tianjin KEXUEXUE YU KEXUE JISHU GUANLI [SCIENTIOLOGY AND MANAGEMENT OF SCIENCE AND TECHNOLOGY] in Chinese No 4, 12 Apr 84 pp 23-24

[Article by Zhang Jiadong [1728 1367 2767] of the Bengbu City Science and Technology Committee, editor Chu Xiao [0443 2556]: "A Preliminary Probe Into the Science and Technology Contract System"]

[Text] Using economic measures to manage the economy so that the economy is suited to socialist laws on commodities and values this is one specific way to use science and technology as production. One form of carrying out the scientific research responsibility system, and of mobilizing the initiative of research units, scientists and technicians is to follow the basic socialist economic laws and apply the economic lever and to use the contract-system method to manage science and technology planning, and scientific research projects. Even though most science and technology contracts are primary forms for individual scientific research projects and technology contracts, they have a certain degree of spontaneity. Seen from trial results, they have many advantages and exhibit a new vitality.

1. The contract system helps implement science and technology policy, strengthen the application, development, and research on production technology, and it helps promote the close integration of scientific research, the economy and society. A suitable path can be found to transfer scientific research results from the laboratory to production units. Science and technology contracts enable scientific research projects to have a clear goal, especially scientific research contracts commissioned by production units, because the sources of scientific research topics arise from actual production. In general, scientific research aims at solving the problems of production technology, or meeting the common needs determined by production. Results of this kind of scientific research can be quickly applied to production, and can create an increasing social wealth for socialism. They can upgrade the role of scientific research in the national economy, and upgrade the enthusiasm production units have for depending upon science and technology to promote production.

2. The contract system helps to raise the management level of responsible scientific research organizations, and to bring about the completion of scientific research tasks. In the past, scientific research management departments used administrative measures to assign research projects and to allocate

research funds, but without getting compensation. Often, they did not strictly investigate the objectives of scientific research, nor did they set forth clear requirements for research. As a result, some projects kept dragging on. By employing the methods of the science and technology contract, they can conduct careful investigations on the topic for scientific research, technological targets, funding, materials, the time needed to finish the project, and economic results. Provisions in the contract are used to define both parties' responsibilities, authorities, rights, and their responsibilities when breaking the contract. As a result, the management level is raised and the efficiency and quality of scientific research work is improved.

3. It helps mobilize the enthusiasm of scientists and technicians and strengthens their sense of responsibility. For a long time, scientific research units have not clearly checked and verified the targets of their projects. Whether their projects are finished or not has little to do with the units or individuals. There is no driving force within the scientific research units and no pressure applied to them from without. To implement the science and technology contract, the target of the project needs to be clearly stated, and the responsibility clearly defined. The common "benefit" becomes the link between those checking and verifying the project and those designating the responsibilities. This is a change from the past when scientific research units "ate from the same pot." Now, well-trained science and technology workers dare to go deep into realities in order to look for problems to study. They take charge of this work and they take responsibility for contract projects. Some of the science and technology workers at lower professional levels will be forced by the situation to diligently study, to master technology, and to upgrade their professional skills. As a result, the enthusiasm of science and technology workers will be mobilized, and their sense of responsibility will be strengthened.

4. It helps to increase the utilization rate of scientific research funds, and to expand the sources of funds. The use of scientific research funds, when implementing a technology contract, can be compensated for, partially compensated for, or can be uncompensated. A certain amount of scientific research funds can be obtained through these compensations, or partial compensations, to cover insufficient funds so that the utilization rate of scientific research funds can be upgraded.

5. It helps to upgrade the efficiency and quality of scientific research. To carry out the science and technology contract system, the appointing unit can break away from the bad habits of monopolies and make free choices. This encourages scientific research competition, and upgrades the efficiency and quality of scientific research.

To sum up the above, the implementation of science and technology contract systems can be an economic lever and a legal binding force. It can mobilize the enthusiasm of scientific research units, and science and technology workers to serve economic construction; it also helps to produce achievement and talent. The contract system is not only a necessity for developing objective circumstances, it also reflects the superiority of socialism, and is more scientific than current administration and management. It creates favorable conditions for

invigorating scientific research, for upgrading the utilization rate of scientific research results, and for furthering the development of technology co-management and the undertaking of contracts. Since the science and technology contract system is something new in our country, it has yet to be perfected. It requires further study, reforms and practice. Therefore, I suggest the following procedures for the study and practice of the contract system:

1. Strictly grasp these four links when signing contracts:

Discussions: The two or more parties involved should proceed from their respective conditions when determining research projects or other related matters. The terms which are required and which are acceptable to both parties will be written down and put into clauses of the contract.

Signing the contract: After affirming that there is no mistake in the wording of the contract, representatives from party A (the commissioning unit) and party B (the accepting unit) will sign and seal the contract.

Carrying out the contract: After the contract is signed, it is legally binding. Both parties should fulfill their duties according to the contract. If one party has difficulty with the process of carrying out the contract, it should obtain the agreement of the other party to revise or break the contract. Otherwise, they will be penalized according to the regulations on breaking the contract.

Checking and acceptance after the contract is settled: When the contract is finished, the leaders of both parties or the personnel involved should form a team to check and accept the contract. Acceptance will be based on the requirements of the contract, and it will work out the conclusion of its investigation. The contract is considered settled when representatives from the checking and acceptance teams, party A and party B, sign and seal the conclusion.

2. Pay serious attention to the supervisory and verifying work of the contract. After contracts are signed, some will not be adhered to in the way they were written, some will not be strictly carried out, and some will be mere formalities. It will be necessary to strengthen contract management, and to fulfill the supervisory and verification procedures in the contract so that the contract will be legally binding.

The principal supervision and verification duties are to examine the contents of the contract, to see whether it is practical, realistic, and feasible, and to see whether the responsibilities, rights and obligations are clearly defined, and whether the conditions set by both sides are workable. The implementation of the contract should be examined, supervised and facilitated.

The make-up of the supervisory and verification unit can be seen in the hierarchical relationship between the two parties that sign the contract, and in the contents of the contract. If both parties belong to the same system, the department in charge will be responsible for the supervision and verification of the contract. If the contract is between systems or between trades, the department in charge of science and technology will become the supervisory and verifying unit. If the contract involves the economy, the banks or the finance departments will be in charge of supervision and verification.

3. When carrying out science and technology contracts, scientific research units have to clearly define and be responsible for the duties, rights and benefits of the science and technology workers involved in national projects. Responsibilities determine rights. Rights then lead to benefits, and benefits are used to encourage responsibility. The scientific research units should have the autonomy to allocate funds, collective benefits and personal bonuses. Units should have the right to grant bonuses, to increase floating wages, and to give job promotion to those science and technology workers who make greater accomplishments and contributions. In terms of the composition of personnel, units can break free from the limitations of science laboratories by hiring new people, and by striving to form a research system team that can cherish the same ideals and follow the same paths and make a concerted effort to accomplish tasks.

4. The present trial implementation of the science and technology contract system will be the initial form to combine scientific research with production. Along with the development of scientific research and production, the contract system will forge research and production into a solid, long-lasting, and unified system.

(a) Organize multi-provincial (city) and multi-prefectural key-task organizations or multi-provincial (city) and multi-prefectural coordination networks. As for general production problems, organize relevant scientific research units, institutions of higher learning, and production units so as to bring into play individual superiority. In this way, technological problems that occur during the process of production can be quickly solved.

(b) Organize integrated bodies comprising local scientific research units and local production units. In the main, use certain products in order to develop either a series of technological studies or a complete set of technological studies, so that they become hot-selling items with distinctive local features.

(c) Organize science and technology development centers or technology development departments within a line of trade or within an enterprise. Pool the technical forces to popularize and apply new technology and develop new products and services.

(d) On the premise of ensuring the accomplishment of scientific research plans, scientific research units and production units can sign a scientific research contract that goes in the same direction as that of our institute.

5. At present, the science and technology contract system is one attempt to use economic methods to manage scientific research. Scientific research, especially in applied technology and developmental technology, directly serves production. Its ultimate goal is to form products. The indicators for measuring management levels in production units are the depletion of labor and the creation of more social wealth. Scientific research, as a special style of production, should include a certain amount of manpower, material, and financial resources so that labor cost creates social wealth. In order to expand revenues for scientific research funds, and to make up for insufficient scientific research funds, fees must be collected for the research projects, for

the transfer of science and technology results, and for the technology services which production units have commissioned the scientific research units to do.

6. Strengthen the leadership of the science and technology contract system. The science and technology contract system is something new in scientific research management. To be further improved, it needs the attention and support of leaders at all levels. By continuously summing up experiences and lessons, scientific research units can acquire the outlook of servicing production and the outlook of being responsible for production, and they can make the promotion of national economic development their major duty.

At present, science and technology contracts are limited to horizontal contracts between scientific research organizations and production units. There are only a few vertical contracts for key national and provincial, planned scientific research projects. To strengthen the management of the planned projects, adopt contract-system methods to limit the amount of time and of funds in order to finish the contract on time. Of course, because of their exploratory nature and many unknowns, key scientific research projects will be allowed a longer time to be finished, though they cannot be dragged on without limit.

After the scientific research contract system has been implemented, departments responsible for scientific-research and scientific research units should upgrade their management level and improve management methods. If a project is coordinated and jointly researched by several units or coordinated by several scientific offices within the same unit, an internal contract or agreement should be signed, so that the responsibilities and divisions of labor can be clearly specified in word form. This will make it convenient to supervise, promote and investigate, and it will ensure that the contract will be fully completed.

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PROPOSALS TO REFORM MANAGEMENT OF RESEARCH FUNDS

Suggestions Offered

Tianjin KEXUEXUE YU KEXUE JISHU GUANLI [SCIENTIOLOGY AND MANAGEMENT OF SCIENCE AND TECHNOLOGY] in Chinese No 11, Nov 83 pp 11-12

[Article by Wang Shuwu [3769 2885 2976]: "Improving the Management of Scientific Research Funds"]

[Text] The basic objective of improving the management of scientific research funds is to produce the optimal research achievements and economic results with the least financial expenditures. The key to this objective lies in strengthening the economic management of research funds. Essentially, this involves the rational distribution and utilization of research funds and improving the economic accounting system, etc. However, the existing system of research fund management at military research institutes still has a number of weaknesses, mainly in index fee control, which are incompatible with the realization of our basic objective. Funds are not distributed in accordance with the funding index of the various institutes based on the number of research topics and their actual needs. Instead, they are determined by the approximate expenses of the institutes over the years. The research institutes must try to complete their projects with very limited funds. With regard to accounting, the institutes must settle their accounts each year, turning over to the higher authorities whatever savings they have made. This practice not only deprives the units of any working circulating funds but also stifles unit initiative since units do not benefit from economizing. As a result, the improvement of the management of research funds calls for fundamental changes which are beyond the capacity of research units and must await serious consideration by higher decision-making authorities.

As the scientific management personnel of a research institute, we are faced with the rather complex task of reforming the management of research funds within the constraints imposed by the present system. This article offers some observations on such a reform at a military applied science institute:

1. The distribution of research funds must be scientifically managed. This requires that the budgeting of research funds be based on rigorous planning and management. Only after the research topics have been selected, complete with evidence, and plans of implementation formulated, would a budget be drawn up and put forward. Herein lies the key to a proper distribution of research funds.

2. The management of research funds should be part of the responsibility system in scientific research. A system of management at various levels should be adopted, combining index fee control with the practice of holding an individual responsible for his finances. Some of the funds will be allocated to the research laboratory and topic groups who will have autonomy in their use. As financial managers, scientific workers will also determine how savings will be used to purchase research materials.

3. A more rigorous accounting system must be enforced to ensure expenditures stay within the budget targets.

4. Research work must be made more efficient through careful reduction and reorganization.

The basic reform principles above translate into more concrete management practices as follows:

1. The annual budgets of all research topics should be proposed in conjunction with their plans of implementation. The two levels—the laboratory and the office—draw up a budget in line with the implementation plans which have been approved.

2. In accordance with the annual budgets of the various research topics and the amounts of discretionary funds to be allocated to the research offices, the research laboratory sets up for the latter scientific research funding targets. Within each office, the people in charge will further divide the funds among the various research groups.

3. The basic jurisdictions of the various levels in classified management are as follows:

Funds for the purchase of equipment and external cooperation by research groups are handled directly by the research laboratory. This is because the system of holding an office responsible for the management of its finances cannot cope with the fluctuations in equipment prices which could be considerable. However, the laboratory guarantees that a piece of equipment that has been approved for purchase in the budget will be acquired even if the final price exceeds the budgeted figure.

Expenses on the depletion of materials (spare parts, processing, maintenance, xeroxing, duplicating) are controlled directly by the responsible people in the research groups. No authorization is required from the higher level.

Discretionary funds appropriated to each office will be handled by the responsible individuals in the office. Essentially, these funds pay for pre-selection studies, preparatory testing, and short study trips approved by the office, and make up any budget deficit caused by the over-spending of a research topic group.

As soon as the expenditures of a research office or group reach budget targets, they will not receive any more funds from agencies supporting scientific research. The offices and groups are autonomous in disposing of their surplus funds, but only for the purpose of scientific research during the particular year concerned. Funds cannot be accumulated for future use.

Obviously, we have to ask scientific research management personnel if the above reforms are to be put into practice. For example, when allocating research funds, the people who manage research funds must be familiar with the implementation plan of every research topic, which requires that they attend as many of the selection, demonstration, and implementation-plan revision sessions as possible. They must understand the objectives, methodology, and targets of the research topics. At the same time, they must develop a good grasp of the distribution of equipment in their institutes in order to have a say in the budget appropriation process. They should be meticulous calculators and strict budgeters, purchasing, allocating, lending, and reserving as circumstances justify, all in a fair and reasonable manner. The exertion of effort at the beginning of the year will simplify matters for the rest of the year.

Laser Institute Reforms Publicized

Tianjin KEXUEXUE YU KEXUE JISHU GUANLI [SCIENTIOLOGY AND MANAGEMENT OF SCIENCE AND TECHNOLOGY] in Chinese No 11, Nov 83 pp 12-14

[Article by Guo Yunping [6753 0061 5493] and Chen Xueren [7115 1331 0088]: "An Effective Measure To Strengthen the Management of Scientific Research Funds"]

[Text] Founded only 7 years ago, the Tianjin Laser Research Institute is staffed mostly with technical and managerial personnel from enterprises. They are unfamiliar with the management of scientific research, particularly the management of scientific research funds, in such a way as to meet the needs of scientific research.

I. Defining the Problem

When the institute was first set up, funds appropriated by higher authorities for each separate project were pooled in the institute. Anyone could use the money, and in an amount he wanted, regardless of his topic and of the way he used it. This practice made scientific researchers, who are not economy-minded to begin with, even less so. They frittered away whatever money there was and were quick to demand more when money ran out. Without money, they could not do a thing other than wait. Since 1977, as research topics proliferated, scientific research funds had gotten out of control. The topic groups differed tremendously in their expenses. Some were running a heavy deficit while others were not assured of the necessary funds, a situation which caused scientific research workers to complain. Who would have thought that a unit with more than 100 people could have reserve goods exceeding 300,000 yuan in 1980? A large quantity of raw materials and components deteriorated while numerous pieces of valuable equipment piled up in the storeroom, completely ignored and unused. Our urgent task now is to transform financial management from a passive into an active function so that it can both control and guarantee funding.

Our original approach was to establish a separate account for each planned research topic. This replaced the old practice of 'eating from the same pot and receiving equal benefits.' A topic had to secure financial resources first before it could be formally established. Under this approach, the heads of the

various research topics did become more careful with money. In time, however, they lost track of the sums of money spent, the quantity of materials received and the amount of funds saved. To find out, they had to check with the finance department. Yet they would not know at once since it took time to forward to the finance department the storeroom material withdrawal accounts, external processing accounts and internal cooperation accounts, etc., which are usually settled once a month. Unaware of the expenses of their own research topics, research personnel used money recklessly now and then.

II. Measures for Improvement

Since mid-1981, we have been using internal checks on a trial basis to control expenditures.

It works as follows:

A. In accordance with approved implementation plans, scientific research funds (including categoric appropriations made by higher authorities, contract payments, and income earmarked for research which is derived from the sale of products, transfer of results, and consultancy services) will be allocated in work orders by the scientific research department to the research office. The work orders spell out in detail the assignments to be performed and provide funding accordingly. The scientific research department reserves part of the funds for exploratory or preparatory researchand to subsidize research topics which have not been budgeted.

B. Based on the work orders and the amount of funds allocated, the finance department issues to each research topic group an internal circulation checkbook (Table 1) and an account book (Table 2).

C. Internal-circulation checks are to be in the charge of the chief of the research group. They cannot be used without his signature.

D. All expenses incurred by the group, for example, to obtain equipment from the storeroom, and for experimental workshop processing and such 'internal cooperation' functions as testing and duplicating, will be paid for by internal circulation checks. To finance outside procurement, external cooperation and study/research trips, internal checks could be exchanged for transfer checks or cash at the finance department.

E. The research group also looks after its own account book. The account book works like a bank savings account to give group members a pretty good idea how much money they have spent at any one time. When the account runs out of money, all functions which have to be paid for will grind to a halt.

F. The scientific research department draws on the discretionary funds to pay for research expenses incurred before the approval of a topic. After the topic is formally established, the research group will repay the advanced sum. If no topic is selected, the expenses will come from the discretionary funds.

G. All internal-circulation checks will be sent back to the finance department where they will be bound separately by topic when the books are closed.

Some examples of the uses of internal-circulation checks:

1) To obtain materials from the storeroom, a scientific researcher must present the internal check, the account book and a withdrawal form. (Separate procedures govern the approval and verification of such withdrawals). After ascertaining the price, warehouse personnel will enter the amount in the check and fill in the account book. The account book will remain with the research group while the internal check will be forwarded to the finance department as proof of the income of the materials department.

2) If the group wants the workshop to do a processing job or put in some spare parts, it must go through the scientific research department so that the latter can delegate the assignment to the workshop. Upon the completion of the job, the workshop will charge the group in accordance with a schedule of fees. Payment will be made by an internal check, the value of which will be entered by the workshop which will also fill in the account book of the group. The workshop will also pass on the check to the finance department as proof of its income. This income can go towards the purchase of tools and small facilities.

3) External services required by a research group will be assigned to the external cooperation personnel by the scientific research department. After completing the job the external cooperation personnel will obtain an internal check from the group and fill in the amount in the check and the account book. The check can then be presented to the finance department in exchange for bank transfer checks or cash to defray the cost of the services rendered.

4) When materials or cash change hands between groups, the deal must be approved by the head of the office and the scientific research department. When permission is obtained, both parties will go to the finance department to formalize the transaction and fill in each other's account book.

III. Results

A. The finance department dropped its passive role and gained control of the way money is spent by the groups, effectively performing its functions as a guarantor and a watchdog.

B. Scientific research personnel became more economy-minded. It is good psychology to put internal-circulation checks under the control of the head of the research group. Secure in the knowledge that their funds would not be appropriated by other groups, scientific research personnel could now spend and budget carefully instead of procuring blindly as in the past. In 1982, the stock of goods at the Tianjin Laser Research Institute fell by 100,000 yuan and there was no basic overstocking of equipment or valuable raw materials. Although research topics doubled in 1982 over 1981, expenditures actually decreased by 80,000 yuan.

C. The reforms heightened the sense of responsibility and initiative of workshop staff and research support units.

D. The reforms stimulated every link in the chain to strengthen its management so that internal checks can circulate smoothly. Also, they increased efficiency by cutting down on petty arguments.

E. Cost accounting in research groups has been strengthened. As all expenses are recorded in detail in the account books, cost accounting is completed at the same time as the research itself. This ensures accuracy and saves time.

F. The changes have improved the handling of goods and materials by the groups. All purchases made and all goods received are recorded clearly in the account books. This facilitates stocktaking at the end of a research project and avoids waste and losses.

IV. Ideas for Improvement

A. We have basically managed not to overspend. However, as a project finishes, the desire to splurge also arises. Better results could be obtained if we use a small portion of the money saved to reward scientific research workers.

B. Workshops and other support units are paid for their services to the research groups. Part of this income should be used as a award to the workers concerned in order to improve their initiative.

C. Operating expenses as well as research expenses should be paid for by internal circulation checks. In accordance with actual needs and with the approval of the laboratory management committee, the laboratory and the research office should appropriate all the operating expenses for the year to the research office and functional offices in the form of internal circulation checks. If the 'surplus as incentive' method can be used, so much the better.

D. The scientific research department should draw up a good fee schedule for internal cooperation functions. The basic units should not be allowed to fix their own prices.

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IMPORTANCE OF TALENT IN DEVELOPMENT OF SCIENCE AND TECHNOLOGY

Beijing RENMIN RIBAO in Chinese 13 Jan 84 p 3

["Talent Is the Determining Factor in Science and Technology Development: Members of Academic Departments Discuss the Training, Use and Mobility of Science and Technology Talent"]

[Text] Members of the academic departments attending the fifth session of the Scientific Council of the Chinese Academy of Sciences advance a number of ideas and proposals on the problems of training and mobility of our science and technology talent.

They believe that talent is the determining factor for science and technology development. In welcoming the world's "New Industrial Revolution" the questions of training and bringing talent into full play must be considered of first importance. Passing through not one, but several generations of strict training is necessary before a large number of science and technology talents with the ability to blaze new trails come into being.

When discussing the question of more up-to-date knowledge for on the job science and technology personnel and teachers, they thought that our country needs science and technology personnel who have wide-ranging knowledge and creativity, not science and technology personnel who are narrow-minded and limited. At present the problem of outdated knowledge on the part of on-the-job science and technology personnel and teachers is rather serious. Under these circumstances, the students who are taught and the researchers who are trained have high grades but are poor in ability and do not meet the needs of the situation. Therefore, they proposed establishing a system of rotational training for on-the-job science and technology personnel and teachers. More up-to-date knowledge must become each person's major duty, creative requirement and strict check.

They believe the current personnel system must be reformed, and a rational flow of science and technology talent put into practice. One aspect of this is to use various methods to draw the outstanding talent to China's Academy of Sciences to do long-term and short-term work; only in this way can the Academy of Sciences become China's base for scientific research. In another respect, the Chinese Academy of Sciences should also actively recommend a group of personnel who are doing fundamental research to go work for departments engaged in applied research or carrying out applied research.

Some department committee members specifically suggested that the greatest obstacle to the rational flow of talent is that research institute personnel may enter their institutes but may not come out of them, they are confined by the organization; with no one coming out, no one else can enter. This can be resolved in two steps; from now on the most important thing is to enter graduate students, post-graduates, advanced scholars and visiting personnel. Graduate and post-graduate fellows are in a period when their creativity is most vigorous. They can bring a definite vitality to the research institutes. It is proposed that hereafter, for every five persons who retire, one will be entered. The majority of graduate students will not be retained at the institutes. In this way, an initial step is taken to circulate talent.

Some committee members also said that above all, we should stress developing the role of our nation's science and technology talent. We should draw on the strong points of foreign scientific knowledge, seize all the opportunities to study advanced economics and technology and all opportunities to train talent. But our starting point should still rest on self-reliance, fully believing in our own scientists and engineers. Only a rational, fitting policy is needed, bringing fully into play the initiative of every category of personnel, for China's science and technology talent to definitely achieve even greater successes.

12643
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IMPORTANCE OF CONTINUING SCIENCE EDUCATION STRESSED

Beijing GUANGMING RIBAO in Chinese 27 Jan 84 p 3

[Article by Tian Fu [3944 1133] of the China Scientific and Technical Association: "Continuing Education for Technical Cadres Must Be Stressed"]

[Text] In the past few years, the ever-changing developments of science and technology have enabled us to see more and more realistically that: basic college courses and graduate education can only impart basic scientific and technological knowledge to our students; on-the-job engineers and other middle and high level science and technology personnel still need to keep pace with the leaps and bounds of science and technology development and constantly receive continuing education. The four modernizations will be difficult to achieve without emphasis on continuing education for science and technology cadres. The China Scientific and Technical Association in the past few years has stressed cadres' education, in particular we have done some work pertaining to continuing education for science and technology cadres, and have gained some knowledge in this area.

Developing Continuing Education Is the Challenge To Meet the New Technological Revolution and the Key Link To Achieve the Four Modernizations

The realities of new developments in world industry have given one important message: that this is a new technological revolution of profound impact confronting mankind. By the end of this century and the beginning of the next, new breakthroughs in science and technology will take place throughout the world. This new situation in worldwide industrial development as far as our national socialist four modernizations is concerned is an opportunity as well as a challenge. How should we meet this challenge? The practice of the China Scientific and Technical Association during the last few years, has found that the definite link is the continuing education of cadre ranks.

In the past 3 years the China Scientific and Technical Association has carved new ways to develop cadre continuing education for all central and local learned societies, associations, and research societies through activities such as academic exchanges, dissemination of scientific knowledge, scientific training and science and technology consultations. We have conducted an estimated 10,000 study classes, advanced study classes, and graduate classes of all different types at the beginning, intermediate and high levels. We have restored and established new science and technology advanced learning academies in each locality; participations of science and technology cadres in continuing education has totaled over 1 million.

With respect to the continuing education of on-the-job science and technology cadres, we have primarily stressed five areas of work: 1) the dissemination of new scientific knowledge, and popularizing technological applications. Through study, science and technology personnel in similar industries are able to extensively master and apply new technology. For example, the Society for Application of Atomic Energy to Agronomy under China's Agronomy Society conducted a series of training classes on the basics of using atomic energy in agriculture, agricultural applications of isotopic tracing technology, radioactive genetic breeding and other courses, promoting the use of the above-mentioned technology in our national agriculture. Taking an example in radioactive breeding, Lu Cotton No 1 is a good variety of cotton derived from using radioactive breeding which on the average increases output by 25 percent. In 1982 it had already been applied to over 30 million mu. Second, it filled in voids in curriculum. The object of this type of study is new developments outside China; but in our country it is still a void, or very weak and fledgling, or a peripheral course of study. In general, the course content is rather systematic and theoretical; the participating students have a definite theoretical basis and practical experience, the majority being middle to high level science and technology personnel. This is clearly useful in accelerating training of talent and opening up new scientific questions for study. Third, it assisted teachers, especially middle school teachers, to supplement and update their knowledge and raise their professional level. This type of training class is generally carried out during the summer. For example, the China Geography Society beginning in 1980 conducted short-term training classes for outstanding middle school geography teachers in each province, municipality and autonomous region throughout China, providing learned reports and introductions to specialized topics. They organized field trips and sightseeing activities, developing exchange experience in middle school geography teaching. Many teachers call the society the student's "lifelong school." Fourth, individual technical training and study classes. This type of study class is aimed at solving practical problems. For example, six societies including the China Munitions Society, the Railway Society, China Electronics Society, jointly conducted a workshop on microcomputers. Over 100 science and technology cadres representing 21 units from 25 provinces, municipalities and autonomous regions throughout China went through the program, basically mastering microcomputer principles and programming, and techniques to operate the computer. Fifth, opening up science and technology advanced learning academies. Based on incomplete data, up to the present time, the China Scientific and Technical Association network throughout China has set up 72 science and technology advanced learning academies. In the past few years, altogether they have conducted 3,944 various specialized training classes for over 165,000 science and technology cadre. Many of these "graduates" fondly refer to the science and technology advanced learning academies as their "gas stations" on the road to the four modernizations.

Continuing Education Must Proceed From Updated Knowledge and Widespread Training in Rotation From Top to Bottom in Order to Prove Effective

During the past few years, in the process of stressing cadre continuing education, the China Scientific and Technical Association has learned that to get a good handle on continuing education for cadres, we must pay careful attention to the following several points: 1) the content of cadre learning. In continuing education for cadres, the primary learning content is Marxism-Leninism and Mao Zedong Thought. In addition, modern science should be studied, including

natural science and social science. Hard sciences should be studied and soft sciences should be mastered as well. In a sense, it is more important to stress the study of soft sciences in continuing education for cadres. A cadre, especially middle or high level cadre, needs to listen extensively to the opinions of the majority of scientists, carry out his own study, understand science management and management science, and study and research leading science. These are all soft sciences. The majority of cadre who have newly assumed leadership positions are strong in one specialty, each being proficient in one specialized technology (often a hard science). But only relying on knowledge in one hard science makes it difficult for them to do leadership and administrative work well. For these cadres, there primarily exists a "softening up" problem, namely to learn management science well. If they can "soften up" they will redouble their might, able to use both soft and hard tactics, intelligence as well as courage; 2) the order of cadre education. We began by following a torturous path. Later in practice we gradually woke up to the truth that cadre continuing education must proceed from top to bottom. When we first started conducting all kinds of advanced learning classes and study sessions, the majority of participants were science and technology cadres working on basic levels. When they returned to their own units to apply what they had learned, problems arose. Because the higher levels in charge had not gone through the programs, the higher and lower levels lacked a common language in the areas of science management and science leadership. This forced us to recognize that cadre education must develop from the top to bottom to prove effective, not from the bottom up. Consequently, we opened up some study classes for leading cadres the next level up, and the results were very good; 3) continuing education for cadre must take the updating of knowledge as its starting point. Today science and technology are advancing by leaps and bounds, and the speed with which new knowledge replaces old is unprecedented. Many experts believe that the production of knowledge today has become the chief "industry," and the primary motive force in economic and social development. To depart from extending knowledge to production, to depart from knowledge updating is to render the four modernizations an empty phrase. So-called knowledge updating is chiefly that of higher level science and technology cadres. In the realm of available new technology, microelectronic technology occupies a particularly important position. As far as the majority of middle-aged science and technology cadres are concerned, because there was no systematic learning of computer know-how in the past, they all have the responsibility for updating their knowledge of computers.

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SUGGESTION ON REFORMING RESEARCH INSTITUTES

Beijing GUANGMING RIBAO in Chinese 8 Jun 84 p 2

[Article by Zhang Guhuai [1728 0657 2849] of Wuhan Rock and Soil Mechanics Institute of the Chinese Academy of Sciences: "Correct Understanding, Expand Self-determination Rights"]

[Text] My institute is one of the trial units in the reform of the Chinese Academy of Sciences. Various task groups are organized freely under guidance. After one year of practice, we have obtained some preliminary accomplishments. In 1983, the institute was responsible for more than 30 early stage research and development projects in energy, transportation and mining. The number of key major projects was 44 percent of the total projects performed in more than 20 years since the founding of the institute. It was also a year in which most engineering and research tasks were undertaken; 95.5 percent of the scientific research plan was completed, which was also the best year. One accomplishment on the international level was obtained; three projects reached the national leading level and seven projects were on the advanced level. The research funding was increased by more than three-fold. By conducting major engineering research projects, the institute also presented seven research topics on rock and soil dynamics.

However, we deeply feel that it is very difficult to reform the research institutes of the Chinese Academy of Sciences, resistance is still high. For instance, our institute received a few hundred thousand yuan last year; however, it was not "legal" to spend a few cents on soybean juice to protect the health of the employees. A while ago, some people wanted the money returned. Personal rewards are also much lower than the proportion approved by the superior; and sometimes withheld. This has seriously damaged the enthusiasm of the technical staff. The institute lacks the self-determination rights to manage its own people, money and materials. Whatever limited authorities we have, many levels of approval are required. In order to accomplish one thing, it is necessary to travel back and forth and waste manhours, money and valuable time.

Different guidance should be given to different institutes during the reform. Institutes handling basic sciences and new technology exploration cannot be held responsible for their own profitability as certain provincial, city and industrial institutes. However, they should not totally rely on government funding. Institutes that are primarily engaged in applied research with many

projects should gradually become self-sufficient. The government may provide a certain level of funding for basic and some applied research. The remaining part will have to be raised by the institute itself. Any excess is not required to be turned over and any shortfall will not be subsidized. The burden is on the institute. By doing so, some pressure is put on the institute to closely correlate science and technology to the national economy.

There is an obstacle in our ideology which considers that the completion of numerous economically related research projects and bringing in more income is not a good indicator for a well operated institute. According to this logic, a research organization does not have to execute the science and technology policies of the Central Committee. It is not necessary to perform engineering research projects related to the economy. Units capable of deriving incomes might just as well stay comfortably in the arms of government funding. Some people mistakenly believe that gearing science to economic construction means less emphasis on basic science. This viewpoint is not right. Our institute presented seven academic topics after repeated discussion among the academic committee members. The scope was wider than before reform and a plan for new technology development was drawn. This experience shows that with the correct understanding and implementing the science and technology policies of the Central Committee, both basic science and new technology can be developed as we contribute to economic construction; particular things improve with the improvement of the general situation.

12553
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PROPOSAL TO UNIFY MANAGEMENT SYSTEM FOR SCIENTIFIC RESEARCH, HIGHER EDUCATION

Beijing GUANGMING RIBAO in Chinese 21 Jun 84 p 2

[Article by Professor Ma Longxiang [7456 7893 5048] of the Northeast Engineering Institute: "A Unified Management System Should Be Adopted for Scientific Research and Higher Education"]

[Text] Since the founding of the PRC, the management system for education and scientific research has basically followed the Russian system, i.e., scientific research and education are managed by separate systems. The Chinese Academy of Sciences was established to manage scientific research and education is partially guided directly by the Ministry of Education. The majority, however, belongs to various trade committees in the central government as well as local governments. Such a system was necessary then but is inadequate now. Because:

1. It hinders the production of more qualified people and accomplishments institutions of higher learning that train specialized personnel are required to exploit new knowledge, which is inseparable from scientific research. Scientific research, however, needs highly qualified people, primarily trained and supplied by institutions of higher learning. Without teaching, scientific research results cannot be passed on and the purpose of training people cannot be achieved. Furthermore, if research results cannot be used to train people, the role of a researcher is not fully developed. It is also a waste as far as the country is concerned. A director of Information and Policy-making Institute at MIT once said that teaching and research cannot be separated. The research results of today should become graduate courses in the next 2-3 years. A few years down the road, they will become undergraduate courses. Scientific research brings vitality to teaching. Someone reviewed certain pertinent information regarding MIT and discovered that the turnover rate of their courses is very high. For example, 56 out of 180 courses offered by the Electrical Engineering Department in 1976 were abolished by 1983, and 75 new courses were offered. The contents of these new courses reflect technical advances in recent years. Although the names of some courses remain unchanged, the contents have been significantly revised. Most well-known universities in the United States have graduate schools. Even in the USSR, research personnel at the Academy of Sciences must teach part-time at institutions of higher learning to pass on new research results to graduate and undergraduate students. The faculty members of higher learning institutions also take full advantage of the facilities at the Academy of Sciences to perform research. In China,

although there are many teachers, research facilities are poor. The government has not invested as much as it has on scientific research units. Therefore, it is more difficult to train qualified people of high standards. On the other hand, a large number of experts and scholars are gathered at research institutes without producing any qualified people and results. In the past, we had attempted the idea of working from several fronts. In reality, it was not possible to coordinate, leading to repetition and waste of human resources and materials.

2. The management institutions of higher learning, especially key multi-disciplinary schools by trade departments is inappropriate for the development of scientific research and education. As the state organs are reformed, institutions of higher learning, especially multi-disciplinary schools managed by the various trade ministry committees become incompatible with the trade or discipline of the committees. Furthermore, the major duty of the committee is to manage production. It is not easy to attend to education as well. Especially with new disciplines and frontier sciences evolving continuously, this incompatibility becomes more significant. Under the influence of "department ownership," other committees closely related to the subject matter cannot interfere. This greatly affects the development of institutions of higher learning. Those with good foundations and strong faculty members cannot make better progress.

For example, the Northeast Engineering Institute was founded in 1951. This multi-disciplinary engineering institute was established by transferring and organizing the strength in mechanical engineering, electrical engineering, mining, metallurgy and materials processing by the Northeast Industrial Department to satisfy the needs of construction. Later, scientific special fields were added to become a comprehensive institution in science and engineering. This conformed to the worldwide trends of science and education. However, this school was placed under the jurisdiction of the Ministry of Metallurgical Industry. Due to trade limitations, mechanical engineering, electric power and coal mining were not given the attention they deserved. Limitations were imposed on investment, recruiting, distribution, research tasks, laboratory construction and academic exchanges, which hindered the development of this multi-disciplinary school. Morover, the management of nonferrous metals was separated from the Ministry of Metallurgical Industry by establishing the Chinese Nonferrous Metals Corporation in order to expand production. Thus, the special fields in the Northeast Engineering Institute will become even narrower under the leadership of Ministry of Metallurgical Industry. The emphasis is placed on training experts in iron and steel. It will be hard to include the training of technical people for the nonferrous metal industry. With the exception of nationally unified recruitment and distribution, the investment, research tasks, laboratory construction and academic exchanges for specialties related to nonferrous metals are totally ignored.

Therefore, I recommend the following:

1. We should implement a unified management system for scientific research and higher education from a long range point of view. By doing so, we can avoid duplication and waste in scientific research to conserve national investment. All the strength can be concentrated to attack specific problems. It also can

improve the quality of the personnel. Of course, we should not treat things in a sweeping manner without considering differences under the present circumstances. We should gradually move in this direction. For instance, more researchers will be mobilized to teach in institutions of higher learning through careful planning. On the other hand, teachers will be organized to enter scientific research institutes to individually or jointly undertake research tasks in their special fields. Qualified people in schools and research institutes will have the opportunity to move around to create the situation for a unified management system. In addition, it is also beneficial for the research management organization to directly invest in research institutes in universities.

2. All multi-disciplinary institutes of higher learning should be directly controlled by the Ministry of Education. Multi-disciplinary schools and various trade departments may sign contracts for training professionals and conducting scientific research. Various trade departments may also invest in relevant schools to solve problems in personnel training and research tasks based on need.

12553
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NATIONAL DEVELOPMENTS

STATE PROJECTS TO PROTECT ARCHEOLOGICAL SITES

OW222108 Beijing XINHUA in English 1914 GMT 22 Sep 84

[Text] Beijing, 22 Sep (XINHUA)--The Mogao grottoes at Dunhuang, also known as the "Caves of a Thousand Buddhas," in Gansu Province, will soon be able to withstand earthquakes up to Richter Scale mark seven.

The major part of the reinforcement work to protect this archeological treasure, which started in 1983, will be completed by the end of this year.

The grottoes are in a small tree-lined oasis in a stretch of desert in the western part of Gansu corridor, on the ancient silk road which led to the Mediterranean.

This protection work is part of a major scheme of the 1978-1983 period to repair and restore more than 450 important historic sites with state funds.

The Mogao grottoes consist of 492 well-preserved caves. They contain more than 2,000 painted statues and 45,000 square meters of murals—enough to fill a gallery 25 kilometers long.

The grottoes were begun in 366 A.D., and were not finished until 1,000 years later.

The Mogao grottoes were listed under state protection in 1961. A major project between 1962 and 1965 strengthened the outer walls of the caves and the loose sandstone rock so that it could withstand pressure and earthquakes, and built new four-tier walkways. Reinforced concrete colonnades against the outer walls hold up the rock and support the walkways.

The Dunhuang Cultural Research Institute, established shortly after liberation in 1949 for the management and study of local art treasures is situated in a large courtyard just below the grottoes.

During this current project, researchers have dug up the site of a two-story hall, the largest at this historic spot.

Through a passageway, the hall links up with the main shrine in cave No 130. The lower story of the hall was built in the Tang Dynasty (618-907 A.D.) and the upper-story in the Qing Dynasty (1644-1911 A.D.) on raised ground after the former had fallen into disuse.

Most of the caves at the Mogao grottoes were restored with a huge sum of money allocated by the state for the 1962-1965 project.

Researchers at the institute began to take various measures to protect the Dunhuang murals in the 1950s, and have carried on efforts since then to restore their original splendour.

They have used lime clay or cement-sand paste to strengthen the edges of murals which were in danger of falling off, and they have used synthetic resin to restore and strengthen murals which cracked or became powdery. Rivets have also been used to prevent some from crumbling.

After intensive research and many experiments they managed to clean 1,000 square meters of murals and more than 30 colored clay statues, which were blackened by smoke.

A more arduous protection project was recently completed on the Maijishan grottoes, known as the "gallery of clay statues," in Gansu Province.

The project was designed to strengthen the grottoes to withstand any earthquake up to mark eight on the Richter Scale. Tianshui, where the grottoes are situated, has been hit by earthquakes many times throughout history.

The grottoes are on a red sandstone mountain top, which, when seen from a distance, looks like a stack of wheat.

The seven-year project cost the state three million yuan.

The grottoes were first hewn from the cliffs in the fourth century A.D., and construction also spanned more than 1,000 years.

Rare treasures they contain include 7,200 statues, 1,300 square meters of murals and many ancient shrines.

The protection project combined "spraying, anchoring, glueing and supporting" techniques undertaken after more than 20 years of research and discussion.

More than 2,000 anchoring rods were stuck into 9,000 square meters of severely weather-beaten sandstone. Then a layer of 10 to 15 centimeters' thick spray was applied to cover the originally exposed cliffs and prevent them from direct damage from wind, sun and rain. The covering was dyed to blend with the surrounding hillside.

Dozens of cracks and fissures scattered in the caves and on cliffs were sealed and stuffed with cement-sand paste, epoxy resin, chemicals and glue. Overhanging rocks and fragmentary stones were given special supports.

More than 1,000 meters of raised walkways were built so that visitors could walk safely between the grottoes. These join the caves on the eastern and western cliffs, which were separated more than 1,200 years ago when the central cliff faces crumbled.

Tourists now have access to eight more Buddhist grottoes on the western cliff, which were completely cut off from the outside by an earthquake. The new walkways link up the 194 caves from the foot of the mountain to an 80-meter-high tower.

CSO: 4010/5

BRIEFS

LIAONING SCIENCE AND TECHNOLOGY--Over the past 35 years, the scientific and technological services have vigorously developed in Liaoning Province. In the early post-liberation period, our province only had 8 scientific research organizations and about 200 scientific and technological workers. At present, our province has more than 300 independent natural scientific research institutions and 540,000 professional technological personnel. Over the past several years, the number of major research results in science and technology have come to 8,000, of which, 890 have received the provincial awards and 41 received national awards. [Summary] [Shenyang Liaoning Provincial Service in Mandarin 1030 GMT 13 Sep 84 SK]

TIANJIN SCIENTIFIC, TECHNICAL PERSONNEL--Tianjin Municipality has vigorously developed its higher education, secondary technical education and various forms of on-the-job training over the past 35 years. In 1949, it had 8,826 personnel specialized in various fields of sciences (excluding social sciences), 1,138 engineering personnel, and 441 teachers at schools of higher learning. Now it has 271,642 technical cadres specialized in various fields. Of whom, 3,509 specialize in natural sciences. This figure is 19.7 times greater than that of 1949. Engineering personnel have increased to 86,628, 76.1 times greater than in 1949, and teachers at schools of higher learning have increased to nearly 10,000. In terms of technical title, the municipality has more than 3,000 people with high-grade technical titles in the natural sciences and has more than 40,000 middle-grade scientific and technical personnel, of whom nearly 30,000 are engineers. It had only 1,800 engineers before the Cultural Revolution. It has also 120,000 primary scientific and technical personnel. [Summary] [Tianjin City Service in Mandarin 0030 GMT 7 Sep 84 SK]

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OBJECT, TASK OF SOCIALIST ENVIRONMENTAL ECONOMICS DISCUSSED

Beijing HUANJING KEXUE [JOURNAL OF ENVIRONMENTAL SCIENCE] No 2, 1984
30 Apr pp 67-70

[Article by Li Kaiwang [2621 7030 2598]: "An Exploratory Discussion of the Object, Task of Socialist Environmental Economics "]

[Text] Environmental economics is a new frontier discipline that investigates the inherent relationship between the environment and the whole socio-economic process. It was born against the historical backdrop of a continuously increasing population, a rapidly developing economy, a fast depletion of resources, worsening environmental pollution and an ecological balance on the verge of destruction. Because this discipline directly affects economic growth, prosperity and human existence and development, many countries in the world are paying it increasing attention. China is a socialist country. The 12th National Congress of the Chinese Communist Party has put forward a master plan for the comprehensive realization of socialist modernization and construction. To ensure its successful implementation, we must emphasize and strengthen environmental economic research and applications.

Every discipline has its own particular object of study. Put simply, environmental economics studies economic issues related to the environment, that is, the inherent and inevitable interactions between the environment, on the one hand, and industrial and agricultural production and other economic activities, on the other. More specifically, environmental economics examines the economic issues of industrial and urban pollution and its treatment, the rational development and utilization of natural resources, and the economic impact of miscellaneous production activities on the ecology.

Environmental economics has been referred to by some foreigners as ecological economics. Despite its intimate relationship with environmental and natural sciences, particularly in its need to make full use of the scientific achievements of ecology, it remains essentially an economic science. From the Marxist viewpoint, it is applied economics with a dual character. One part of it is generally scientific, the other part is social and class in nature. From the perspective of the relationship between environmental issues and the development of production forces,

modern environmental pollution and destruction can be traced directly to the "side-effects" of the development of modern production forces. In the final analysis, the solution of existing environmental problems lies in modern science and technology and in modifying the way we organize production. In this respect, the issues facing all countries, socialist or capitalist, are basically the same and belong to the realm of general science. With China's specific conditions in mind, we should draw upon and learn from the experiences of capitalist countries analytically, e.g. in the rational distribution of production forces, the rational utilization of resources, energy economies, the overall urban design, the measurement of environmental quality, technical economic evaluation and forecasting, and environmental engineering. But socialist environmental economics does differ in principle from capitalist environmental economics concerning the scientific way in which environmental economics reflects how it comes to grips with and makes use of objective laws. Different social systems, different class interests, different social economic conditions - they all determine the different approaches people take towards environmental issues and their solution. Hence the birth of the two different varieties of environmental economics: socialist environmental economics and capitalist environmental economics. Naturally we can emphasize only the study of socialist environmental economics.

What are the object and tasks of socialist environmental economics? There is as yet no comprehensive, systematic and unanimous understanding of this topic and further studies are needed. However, judging by China's situation, socialist environmental economics should mean the application of Marxist political economy, the economics of productive forces, and dialectical materialism to the study of environmental economic issues in socialist construction. That is, the study of the inherent and inevitable interactions between the environment and China's industrial agricultural production and other economic activities. Socialist environmental economics should also clarify and identify the economic factors that contribute to environmental pollution and ecological destruction and the economic measures that could solve such problems. The development of science and technology and the phenomenal growth of production forces have brought many benefits to mankind, making possible the geometric increases in industrial and agricultural output. On the other hand, however, we have also taken a heavy toll on the natural ecology. Take China, for instance. Since the founding of the People's Republic, our socialist economic construction has made much headway due to the Party's leadership and the superiority of the socialist system. But production gains have not kept pace with environmental pollution, the latter deteriorating much faster than industrial and agricultural output has been growing. During the ten disastrous years, production actually dropped, and environmental pollution worsened rapidly. Although the seriousness of our environmental problem is related to our agricultural industrial development, environmental pollution is not an inevitable consequence or development. We have serious environmental problems because we lack subjective experience and make mistakes in economic work. In the distribution of production, for instance, we fail to take

environmental issues into consideration -- building factories that discharge toxic effluent in the upper reaches of rivers flowing through cities, and others that give out toxic gases in densely populated large and medium-sized cities. For a long time during capital construction, neither planning nor construction paid any serious attention to environmental protection or the treatment of the "three wastes". Environmental problems in China are not limited to industrial pollution, but also include the severe destruction of the natural ecology and the issues arising therefrom, such as soil erosion and desertification.

What are the characteristics of socialist environmental economics? How does it differ from capitalist environmental economics? I believe the main points are:

1. IT IS GUIDED BY MARXISM AND MAO ZEDONG THOUGHT. The scientific system of Marxism is the world outlook of the proletariat. It demands that we discard any prejudices and selfish interests held by the exploiting class. It also demands that we understand and re-mould the world in strict accordance with the truth of objective things and with the basic interests of the entire nation as our point of departure. Socialist environmental economics applies the Marxist stand, viewpoint, and method to the study of the contradiction between production development and the natural ecosystem, especially the ways in which this contradiction is reflected in the economic relations between peopoe, and the interactions between economic relations and ecological contradictions. The economic factors that lead to environmental problems, the economic policies that might solve such problems, the economic results and losses that arise from changes in the environmental quality and their costs and transfer --all these problems and their solutions inevitably involve stand, viewpoint and method, as well as man's world outlook.

2. SOCIALIST ENVIRONMENTAL ECONOMICS MUST TAKE MARXIST ECONOMIC PRINCIPLES AS ITS THEORETICAL BASIS. We must conscientiously apply socialist economic principles, fully exploiting its superiority to solve environmental questions. Contemporary capitalist economics has many branches. We should critically absorb that part of their teachings which is really scientifically significant. But under no circumstances can we take capitalist economics as our theoretical basis or as an ideology. For example, while we certainly need to work out an economic solution to the miscellaneous issues which have arisen from the free exploitation of resources, and many scholars have suggested that free exploitation be replaced by exploitation with conpensation, even touting the idea of "shadow pricing", we must unreservedly reject the viewpoint put forward by bourgeois economists that "given today's world conditions, the consumption theory of value, including the intrinsic value of rare resources, is closer to reality than the production theory of value." Also to be refuted is the conclusion they have thus drawn: "resources which have not been refined by human labor also have a naturally endowed value." Otherwise, we would consciously or unconsciously be deviating from the "labor theory of value", the theoretical cornerstone of Marxian economics. Certainly, socialist environmental economics should not be content with

the application of the existing scientific conclusions of Marxian political economy and production economics. Instead, it should enrich and elaborate Marxist economics by coming up with new solutions and achievements in its investigation of the emerging set of circumstances.

3. IT MUST SERVE SOCIALIST MODERNIZATION CONSTRUCTION. Environmental economics in China must be closely integrated with the implementation of the country's socialist economic construction, correctly summing up both our positive and negative experiences in tackling environmental issues. At the same time, it must study and learn from foreign experiences and, with China's actual circumstances as a starting point, reveal the objective laws, not subjectively concocted ones, inherent in the unity of opposites between economic development and environmental protection. In other words, it must explore a Chinese approach to environmental problems in light of China's specific conditions and the requirements imposed by its different stage of development. At China's present developmental stage, the main task of socialist environmental economics is to examine the economic costs and benefits and social consequences of our attempts to re-mould and exploit the natural environment and of our efforts to reconcile and control the contradictions between man and his environment. Such an examination must be conducted in accordance with the demands of objective natural laws and socialist economic laws. Its objective is to discover a correct way to utilize natural resources naturally, a way which would combine prevention with treatment, but gives the former priority.

First, it must explore the inherent interactions and dialectical relationship between socialist construction and the natural ecosystem, from the viewpoints of economics and management. It must bring to light the objective laws governing the balanced development between economic growth and environmental protection, formulate environmental policies for the Party and the country, and provide a basis for strengthening environmental management.

Second, it must investigate the basic theories underpinning environmental economics and clarify how the laws of socialist economics can be applied to environmental issues, with special reference to the integration between theory and practice. Among those laws, the most important ones are the basic socialist environmental economic laws, laws to guide the planned, proportionate development of the national economy, and the law of value, etc. As Stalin pointed out, "It is the objective of socialist production to guarantee that the constantly growing material and cultural needs of society will be satisfied to the greatest extent possible." ("Socialist Economic Problems of the Soviet Union", People's Press, 1952 ed. p 70.) The objective of socialist production and the means for achieving this objective determine the substance of socialist production and construction and form the point of departure for all our economic work. The objectives of environmental protection are identical with those of socialist production. A beautiful and comfortable environment is also a necessary and essential part of man's material and spiritual life. Only after we clarify this point in theory could we establish the position and functions for environmental protection work in the entire process

of social reproduction and in the total national economy. Only then could we expedite China's environmental protection work. As for the means of achieving the objectives of socialist production, we have to depend mainly on progress in science and technology, that is, advances in high technology which make possible uninterrupted production growth and continuous improvements. This high technology should include demands beneficial to the environment. To bring about technical transformation in a planned way during the Sixth Five-Year Plan period, for instance, we must insist that the overhaul of any piece of equipment and the reform of any technique benefit both productivity and the environment and that they rationally regulate the material interchange between man and nature.

Third, it must examine the economic results and impact of economic planning and enterprise management on environmental protection. Environmental pollution and destruction often arise from incomplete planning, the irrational organization of production forces and inept enterprise management. Therefore, to prevent pollution and protect the environment, we must begin by strengthening national economic planning, readjusting the distribution of production forces, and improving inept enterprise management. To make rational use of natural resources, we simply must reform irrational economic systems and structures, increase the output of enterprises and raise their environmental management standard, at the same time correctly controlling national economic proportion. Environmental economics must emphasize research into the proportionate relationship between developmental economics and environmental protection. Environmental protection is not an object of consumption, but an important integral part of the entire national economic system. The economy of a socialist country is an integrated entity, with a series of proportionate relationships. However, very few people in the past studied the ratio between developmental economics and environmental protection. In fact, this ratio not only runs through all the ratios in the national economy, but is also an important ratio in developmental economics. Our neglect in the past could not but be a serious falw in the theory and method of China's national economic planning. Today, the country has begun to pay attention to environmental requirements in determining its strategies for economic and social developments and haw written into the Sixth Five-Year Plan a chapter on the environment, outlining a series of such requirements. This is a good beginning, a sign that the nation now takes environmental protection very seriously. However, it would hardly be possible to carry through with our environmental protection plan without changing the system, processes and methods of our planning. This is because even today many people still regard environmental protection simply as a ratio of planned economic targets, and fail to recognize it as an essential basic target for the comprehensive equilibrium of a planned economy. Consequently, an urgent task for environmental economics is to examine the following areas intensively by making use of the laws of socialist planning conscientiously--the guiding ideology and target system of planning, the substance and methodology of integrated balanced planning, and planning system and process--in order to contribute to the coordinated development of economic growth and environmental protection.

Fourth, it must weigh the resultant economic costs and benefits as we develop natural resources and alter the natural ecosystem, and select the best development plan. As this is an economic question as well as a technological one, it requires detailed studies.

Fifth, it must study the economic consequences of environmental pollution prevention and treatment measures, and provide a basis for the formulation of the best environmental pollution prevention and treatment plan.

Today, China is confronted with numerous environmental problems. Environmental pollution and destruction take a heavy toll on the economy. Environmental economic research must be emphasized and strengthened. To ensure the smooth development of China's socialist construction and achieve the objective of quadrupling the nation's total agricultural and industrial output value by the end of the century, we must stress and strengthen environmental economic research, guide the people towards understanding the laws of nature and those of economics, and act on them in order to steer the country's socialist economic construction towards a benignly perpetuating course. Marx said, "The socialist man, the associated producers, regulate their interchange with nature rationally by bringing it under their common control, instead of being ruled by it as by some blind power; that they accomplish their task with the least expenditure of energy and under conditions most adequate to their human nature and most worthy of it." ("Capital," by Karl Marx, Vol 3 pp 926-927. Published by People's Press, reprinted by Shandong People's Press, June 1975). This is the basic task of environmental economics and the glorious mission of the environmental protection worker.

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CSO: 4008/297

STANDARDIZATION OF ELECTRICAL EQUIPMENT IN MACHINE TOOLS SURVEYED

Dalian ZUHE JICHUANG [MODULAR MACHINE TOOL] in Chinese Nos 2 and 3, 1984

[Article by Gao Fuxiang [7559 4395 4382]]

[No 2, 1984 pp 22-28]

[Text] PART ONE

Standardization is an important measure for the organization of modernized production, and it is an important component of scientific management. Technical standards are an important measure for guaranteeing product quality, for promoting technological progress, and for achieving the best economic results.

We must make great efforts to pursue standardization in order to transform the backward situation in China's science and technology, to strive to improve product quality, and to promote technological progress. We must actively adopt international standards in order to promote international technological and economic cooperation and exchange. This is an important technological and economic policy in China.

This article is a simple review and analysis of work to standardize the electrical equipment used in machine tools. Moreover, it will introduce an outline of the well-understood International Electrotechnical Commission standards for electrical equipment used in machine tools for reference purposes.

1. A Review and the Current Situation in Work To Standardize Electrical Equipment Used in Machine Tools in China

Since the founding of the country, there have been no complete and systematic standards for the electrical equipment used in machine tools. Several technical requirements based on suggestions by Soviet specialists at that time were drafted during the 1950's, but no formal documents were ever completed (in reality, they were several investigation projects). Only in the 1960's were several articles combined into the "GC1-60 Technical Specifications for Interchangeable Metal Cutting Machine Tools." During the 1970's, however, the standards were revised into the "JB2278-78 Technical

Specifications for Interchangeable Metal Cutting Machine Tools", and these few simple electrical requirements were removed. Thus, an overall review of the past shows that there were no independent standards for the electrical equipment used in machine tools. This also is one of the primary reasons for the poor quality and low level of electrical equipment used in machine tools in China in the past.

Technological developments and greater trade and exchanges between nations make it essential that there be high quality and high standards for the electrical equipment used in machine tools. For this reason, the Bureau of Machine Tools instructed the Beijing Machine Tools Research Institute to formulate the "Provisional Decisions on the Technical Specifications for Electrical Systems Used in Export Machine Tools." They next formulated the ministerial standards "JB2738-80 Technical Specifications for Electrical Equipment Used in Machine Tools, Part One, Electrical Transmissions and Controls in Common Machine Tools." The Bureau of Machine Tools sent out several notices and carried out supervision so that the enterprises and units under its jurisdiction would implement them quickly, and it convened an experience exchange meeting at Baoji to summarize their experiences in implementing the ministerial "JB2738-80...." standards. At the meeting, leading comrades from the Bureau of Machine Tools further explained that all machine tools for export and all machine tools sold within the country should be inspected according to this standard. The conference decided that the standards would be implemented for export machine tools beginning on 1 January 1983, and for domestic sales of machine tools on 1 January 1984. The implementation of the ministerial standards "JB2739-83 Graphic Symbols for Machine Tool Electrical Circuits" was also announced at the meeting. In order to put the graphic symbols into use, the Bureau of Machine Tools also issued a decree [(83) Machine-Quality Printing No 196] and required that the machine tool industry put it into effect on 1 January 1984.

In order to assure that there is a single unified standard in the editing of technical documents related to electrical equipment used in machine tools in China, a small drafting group headed by the Beijing Machine Tools Institute is now working very hard to make it easier to formulate high quality, high level standards. It is predicted that these standards can be completed in published form by the end of this year.

Although there has been a very long period of history since the founding of the country, there have been no complete and systematic standards for electrical equipment used in machine tools. Several standards have been formulated in succession in recent years, and this has accelerated the pace of standardization work. It can be predicted that electrical equipment used in machine tools can be improved in both quality and standards within a fairly short period of time. This will make a new contribution both to the flourishing machine industry and to the four modernizations.

II. Overview of the International Electrotechnical Commission (IEC) and its Standards for Electrical Equipment Used in Machine Tools

1. Overview of the International Electrotechnical Commission (IEC)

The IEC is the acronym for the International Electrotechnical Commission. It was founded in 1906 as the world's first international organization. More than 40 nations now participate in it. Its aim is to coordinate unified international electrical engineering technical standards in order to facilitate technological exchanges and eliminate barriers to trade. Specialized IEC standards are now being expanded gradually and have moved from electrical power products to electronic products. The IEC has more than 80 technical committees (TC1-TC81). The technical committees have established subcommittees (SC), and the subcommittees have established work groups (WG). Each committee is responsible for work in a single area. For example, TC1 is the Technical Committee on Terminology, TC3 is the Technical Committee on Graphic Symbols, TC 44 is the Technical Committee for Electrical Equipment Used in Industrial Machinery, and so on. Each technical committee is responsible for the compilation of standards in the area under their responsibility. The standards are numbered according to publication labels, and each publication is a standard. The Central Office of the IEC is located in Geneva.

In 1947, the IEC joined the ISD [as published] (International Standardization Group). After discussions, the IEC assumed responsibility for the fomulation of technical standards for electrical engineering, but it still maintains financial and technical independence. More than 1,500 volumes of electrical engineering standards had been formulated by 1981.

China joined the IEC in 1957, and attended seven annual conferences of the commissions between 1958 and 1965. We did not participate in any of the commission's activities from 1966 to 1973, however, but have attended several annual conferences and more than 10 TC and SC activities since 1973. China's IEC Committee is located in the National Bureau of Standards. China is one of 12 nations on the Executive Commission of the IEC. China sent representatives to participate in a Meeting to Commemorate the 75th Anniversary of the Founding of the IEC in Montreux, Switzerland in 1981. This meeting studied questions related to the standardization of electrical equipment used in machine tools. It was also decided at the meeting to establish a new work group (with participation by the IEC and ISD) to be responsible for research and formulation of standards for Flexible Manufacturing Systems (FMS) and microprocessor control systems.

It should be pointed out that, although the standards issued by the IEC were approved after discussions by all member countries, they are still only recommendations and suggestions. Each country can decide how to apply them according to its own conditions. Switzerland and India, for example, have adopted IEC standards intact as their own national standards. The principles behind the standards used by China are:

1) All international standards should be actively employed by China.

2) Where there are no international standards, we should adopt the standards of advanced industrial countries.

2. IEC Standards for Electrical Equipment Used in Machine Tools

Based on the division of labor in the IEC, TC44 (Electrical Equipment Used in Industrial Machinery) is responsible for the formulation of standards for electrical equipment used in machine tools. Those standards for electrical equipment used in machine tools that have already been issued are listed below, and cover eight volumes (standards).

The first part is Volume 1 of Publication 204-1 (1965), Interchangeability of Electrical Equipment Used in Machine Tools. Four supplements to Publication 204-1 were issued from 1969-1979. The first supplement was Publication 204-1A (1969), the second was Publication 204-1B (1975), the third was Publication 204-1C (1975), and the fourth was Publication 204-1D (1979).

The second part is Volume 1 of Publication 204-2 (1967).

The third part is Volume 1 of Publication 204-3 (1968), covering Interchangeability of Electronic Equipment Used in Machine Tools. The first supplement to this part was published in 1979 as Publication 204-3A.

Some of the standards for electrical equipment used in machine tools were formulated by other technical committees of the IEC. Examples include the graphics symbols used in circuit diagrams, the methods used to represent components in circuit diagrams, and so on. These were adopted from the basic standards that were formulated by the TC3 (graphic symbols) technical committee.

The contents of the eight publications mentioned above show that the standards for electrical equipment used in machine tools can be divided into two types. The first type primarily concerns symbolic descriptions. Symbolic descriptions provide certain technical requirements for guaranteeing safety, improving reliability, facilitating use, safeguards and other aspects of electrical equipment used in machine tools. The first part of the ministry standards now employed in China (JB2738-80 Technical Specifications for Electrical Equipment Used in Machine Tools--Electrical Drives and Controls for Common Machine Tools) was compiled primarily on the basis of this part. Part 2 primarily concerns drafting standards. Charts are used to explain what types of technical documents are needed by the electrical equipment on a machine tool, as well as the technical content of each technical document, and so on. This part is one of the references being used in the "Rules for Drawing Circuit Diagrams for Machine Tools" that China is now formulating.

Based on the conditions of the above two types of standards for electrical equipment used in machine tools, the IEC is considering the further expansion of the scope of their application (they are suitable not only for electrical equipment used in machine tools, but also are suitable for other production machinery). The Meeting to Commemorate the 75th Anniversary of the Founding of the IEC in Montreux, Switzerland in June 1981 decided that the eight original publications on standards for electrical equipment used in machine

tools described above should be revised and supplemented into two new publications. The first part still deals with symbolic descriptions. The IEC has sent this publication to China, and it is now being translated. China will also use these standards for revising and supplementing the ministry standards "JB2738-80". It will be raised to international standards after the revision is completed. The second publication also concerns drafting standards, and is now being revised by the IEC. When the third publication is issued, China will revise and supplement its ministry standards on "Rules for Drawing Circuit Diagrams for Machine Tools" according to this publication. When this occurs, the ministry standards on "Rules for Drawing Circuit Diagrams for Machine Tools" will be revised again to conform to international standards.

Because of the above situation, we do not yet have a detailed understanding of the actual content of these two publications. This article, therefore, will introduce the two original standards for electrical equipment used in machine tools. We understand the original ministry standards "JB2738-80" because they have already been issued and used by everyone. For this reason, we will reintroduce certain IEC standards related to the electrical equipment used in machine tools.

2.1 Technical Documents That Should Be Provided for the Electrical Equipment Used in Each Machine Tool

To permit easy and rapid installation, operation and maintenance of the electrical equipment used in machine tools, there should be drawings, circuit diagrams, graphs, tables and explanations for such equipment.

The technical documents that should be provided for the electrical equipment used in each machine tool can be determined according to the degree of complexity of the equipment. Generally, there should be circuit diagrams, layout diagrams, installation diagrams, interconnection diagrams, explanations of operational procedures, detailed lists of electrical equipment, lists of easily-worn parts and the auxiliary parts used in the equipment (when needed), and so on.

Standards have been determined for some of the illustration methods used in certain of the electrical diagrams in electrical equipment used in machine tools (such as methods of drawing circuit diagrams, methods of linking up interconnection diagrams, etc). These decisions on standards were basically formulated by the TC3 (graphic symbols) Technical Committee. Some of the electrical diagrams for electrical equipment used in machine tools were drawn upon directly, while others were applied after any appropriate supplementation. For this reason, in order to understand some of the decisions concerning illustration methods and interconnection methods in the electrical diagrams related to electrical equipment used in machine tools, we must become familiar with the standards and concrete decisions of the TC3 (graphic symbols) Technical Committee in the area of electrical illustration. This will aid us in understanding the related electrical diagrams of electrical equipment used in machine tools.

Because the TC3 Technical Committee has formulated several standards, only the strong current parts of the electrical diagrams or machine tools are needed at present.

2.1.1 Recommended Methods for Drawing Circuit Diagrams

A. Functions and principles of simplification in circuit diagrams:

A circuit diagram uses the graphic symbols specified for electric machines, components in electrical appliances, and modules to illustrate the various activities that can be achieved by the circuit connections and the circuit itself of an actual piece of electrical equipment. This sort of a diagram is one of principles, and does not concern the measurements, shape and locations of electrical machinery and electrical appliances. In the same set of diagrams, however, the graphic symbols for identical components (such as relays and relay circuits) should be drawn at the same scale as the graphic symbols.

The scale of diagrams should be determined according to the degree of complexity of the circuit diagram, the level of diagram recognition of the personnel that manufacture and use them, ease in managing blueprint bindings, and the use of computers for supplementary design. For the examples provided, it is best to use the width of standard No 3 paper and No 3 longer blueprints.

Circuit diagrams can be simplified according to the following principles:

1) Use square or rectangular forms to illustrate parts of complex circuits. However, the contents of the squares or rectangles should be explained in a detailed manner in appropriate locations on the blueprints.

2) Several similar complex circuits can be drawn on the blueprint, while the remaining ones can be simplified using other graphic symbols.

3) If the Circuits of other ministries or public circuits can be used to understand a particular circuit, then the circuit can be simplified.

4) If the principles are illustrated while the interconnection relationships are not shown, a single line can be used to represent the entire circuit and parts of the circuit.

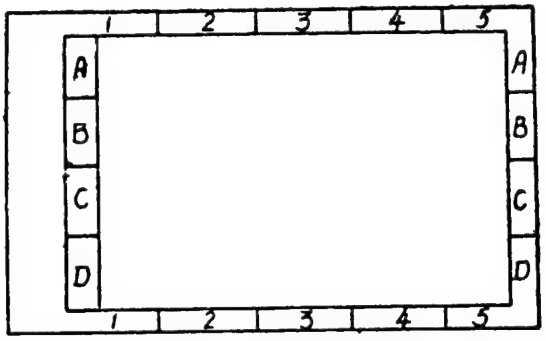
B. Illustration methods in circuit diagrams:

There are three methods in the standards: the reference grid systems illustration method, the tabular systems illustration method, and the circuit symbol systems illustration method.

1) The reference grid systems illustration method shows certain rectangular areas of the blueprint components. An example is Figure 1, which uses numbered columns from left to right and lettered rows from top to bottom. The width and height of the areas can be determined according to the degree of complexity

and the actual requirements of the circuit diagram. In this way, the components or parts can be located within their own area to facilitate recognition. In some cases, rows or columns can be used alone to show the locations.

Figure 1. The Reference Grid Systems Representation Method



2) The tabular systems illustration method places the component codes on top of the related symbols along the horizontal borders of the blueprint. Example tables arrange similar components in a row, or the components can have fixed positions (usually used in electronic circuits).

3) The circuit symbol systems illustration method assigns a number to each circuit, and the numbers are used to distinguish the locations of the components or parts.

C. Illustration of the content of circuit diagrams:

1) Illustration of power sources. The circuit can be drawn horizontally or vertically. When using direct current and single phase circuits, the power source line is place on the upper and lower sides (Figure 2), or on the left and right sides (Figure 3), with the circuit in the middle.

Figure 2. Representation of Power Sources in Vertical Circuit Diagrams

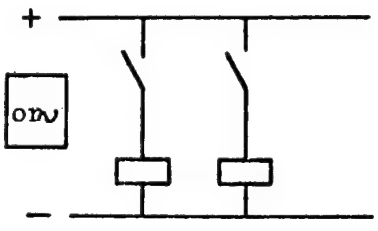
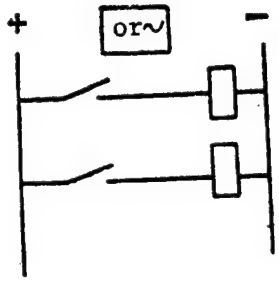


Figure 3. Representation of Power Sources in Horizontal Circuit Diagrams



Multiphase circuits can centralize the power source lines on one side or at the top. The sequence of three-phase circuits should be arranged from left to right (with vertical drawings) or from top to bottom (with horizontal drawings), as shown in Figures 4 and 5.

Figure 4. Representation of Three-phase Power Sources in Vertical Circuit Diagrams

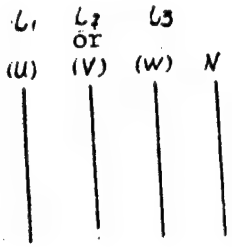
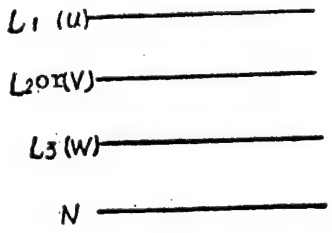


Figure 5. Representation of Three-phase Power Sources in Horizontal Circuit Diagrams



2) Illustration of wires in circuit diagrams. Wires can be represented with a single line or multiple lines on circuit diagrams, as introduced in "JB2739-83". What we wish to introduce here is representing the interconnection of two wires. The standards use small cirular dots (see Figure 6) or small open circles (See Figure 7) or direct connections (See Figure 8).

Figure 6. Using a Small Dot To Represent a Connection Between Two Wires

Figure 7. Using a Small Circle To Represent a Connection Between Two Wires

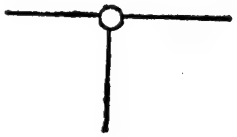


Figure 8. Representing Two Connected Wires Without a Small Dot or Circle

Consistency must be maintained in a set of blueprints, however. As opposed to Figure 8, when two lines do not connect, the method of a change in direction a short distance from the point of intersection can be used (see Figure 9), or a wire can be broken and arrows drawn at the two ends of the broken wire, in conjunction with an explanatory footnote (see Figure 10). Lines of different thickness can be used to emphasize or distinguish between different circuits (such as primary circuits or control circuits).

Figure 9. Representing No Connection Between Two Wires by Drawing an Angle at the Beginning

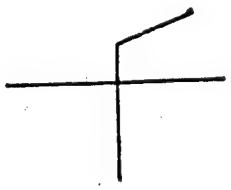
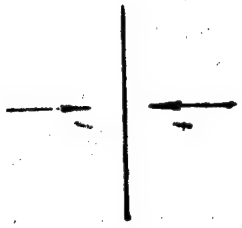


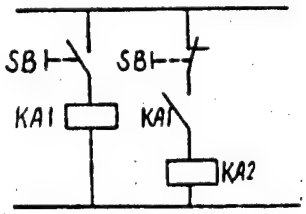
Figure 10. Using Arrows To Show No Connection Between Wires



3) Representation of parts in circuit diagrams. There are three methods for representing the parts on an circuit diagram:

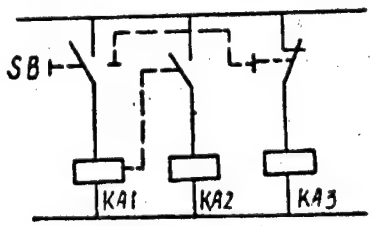
The first is the centralized representation method. This method permits several parts or components such as the coil and contacts of the same relay or the contacts of a switch to be centralized and drawn in the same location, as shown in Figure 11. It can be seen from Figure 11 that the coil and contacts of coil KA1 are located together, and that both of the contacts of SB are located together. This method of illustration can be used when there are few components in the circuit diagram and when the circuit is relatively simple. This method should not be used when there are many components or when the circuit is fairly complex,
very disorganized.

Figure 11. Centralized Representation of Components



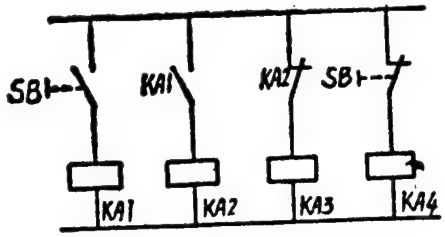
The second type is the semi-centralized illustration method. This method uses mechanical connection symbols (dashed lines) to join the coils and contacts or the various contacts of the components of many parts, as shown in Figure 12. Although this method provides a direct view, it will appear to be very disorganized when the circuit diagram is complex and there are many interconnecting wires. It can be seen from the diagram that the coil of KA1 is interconnected with its own contacts, and the contacts of the SB itself are connected to the contacts.

Figure 12. Semi-centralized Representation of Components



The third type is the decentralized representation method. The decentralized illustration method can simplify the circuit. When this method is used, the components can be placed differently according to circuit requirements, as shown in Figure 13. It can be seen that this method of representation is fairly clear. This is the common method used in circuit diagrams in China at present.

Figure 13. Decentralized Representation of Components

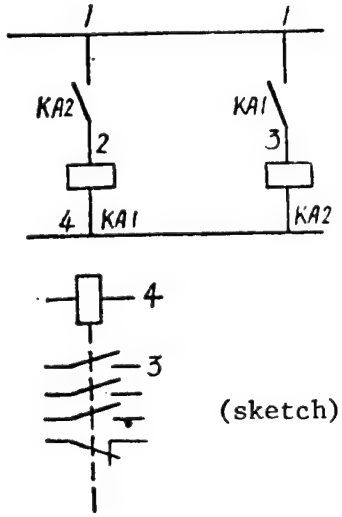


It should be explained that these illustration methods can be used in combination.

Because the decentralized representation method has the advantage of clarity in circuit diagrams, it brings on the question of how to most quickly distinguish between the position and number of components in the same part (that is, how to quickly find the contacts and determine their number in a coil). For this reason the standards recommend the following two methods of representation: the illustration method and the tabular method.

The illustration method uses drawings for representation, as shown in Figure 14. It can be seen from the diagram that the coil of the relay coil uses wires 2 and 4, while the moving contact uses wires 1 and 3. It also can be seen that the relay has a total of four contacts, three being moving make contacts and one being a moving break contact.

Figure 14. Insert Diagrams for Components



The tabular representation method turns an illustration into a table, as shown in Figure 15. The positions (columns) of the moving make contacts and the moving break contact are shown at the top. The unused contacts are represented with an "X". The left column shows the moving make contacts, and the right column shows the moving break contact. If there is a connector, then the primary contact should be drawn with three divisions, with the leftmost being the primary contact, the middle one being the moving make contact and the rightmost being the moving break contact [see Figure 16].

Figure 15. Tabular Representation of Components (Relays)

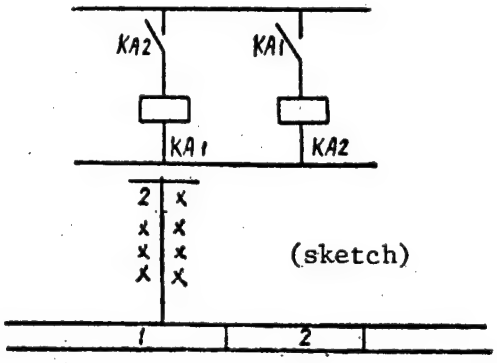
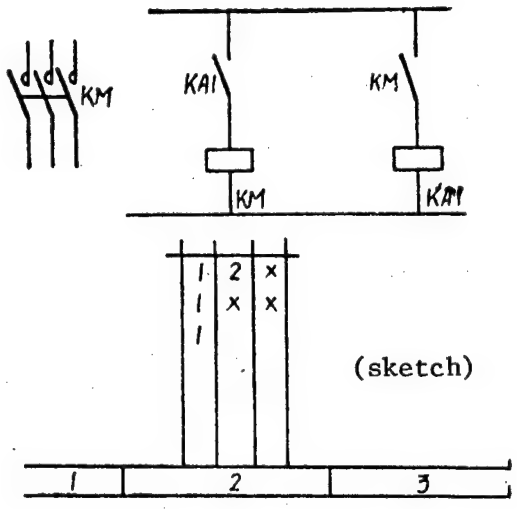


Figure 16. Tabular Representation of Components (Contacts)

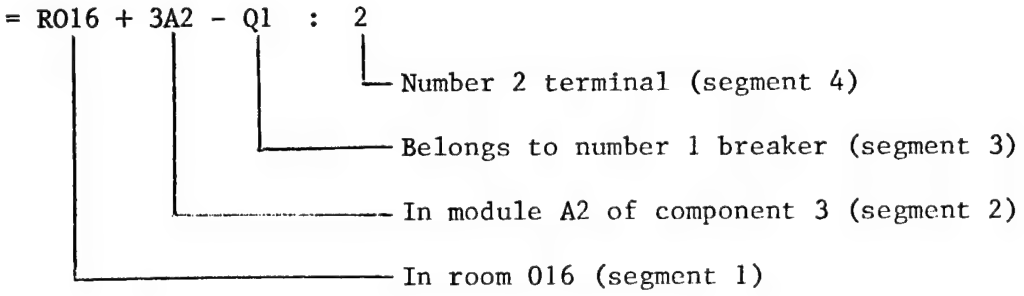


4) The representation of components codes on circuit diagrams. Because there are many types of equipment and components in electrotechnology, in order to facilitate safeguards, maintenance and other goals, the equipment or components should be assigned numbers in groups. It is proposed that the principle of assigning numbers in groups uses the following coding segments:

Segment 1	Segment 2	Segment 3			Segment 4
1	2	3A	3B	3C	4
= Subordinate	+ Location	- Type	Sequence number	Function	: Terminal

The " = ", " + ", " - " and " : " are descriptive symbols and can be omitted if it does not cause confusion, or they can be replaced with footnotes.

Examples of the application of the code segments described above include:



All four of the code segments do not have to be used for each actual piece of equipment or component. The code for each component on the circuit diagrams of machine tools is derived according to the principle for numbering the third segment. The third segment is formed of 3A, 3B and 3C. Part 3A provides the related item or component type, and can consist of one or more letters, although one is best. The Latin alphabet (with the stipulation that the letters I and O not be used) and Arabic numberals should be used. Each letter code represents a type of item (see Table 1). Part 3B uses numbers from 1 to n in a successive arrangement. Part 3C is the function (use) code of the item. This code also is formed from letters (the letters I and O are not used). Each letter refers to a particular use. The component codes should be placed near the appropriate graphic symbol (see Table 2).

5) Representation of contacts. The contacts of all components in the same circuit should run in the same direction.

Table 1. Letter Codes and the Item Types They Represent (for use in segment 3A)

Letter Code	Type of Item	Examples
A	Component or part	Vaccuum tubes, transistors, transductors, lasers, pulse blockers
B	Transducers (from non-coulometric to coulometric or vice-versa)	Thermoelectric sensors, thermal batteries photoelectromagnets, dynamometers, crystal transducers, microphones, pickups, loudspeakers, synchronometers, resolvers
C	Capacitors	
D	Binary components, time-delay components, storage components	Combined components, delay lines, bistable components, monostable components, core memory, registers, tape recorders, disk recorders
E	Miscellaneous items	Photo components, thermal components, components not shown elsewhere in this table
F	Safety components	Fuses, overvoltage dischargers, Lightening arrestors
G	Generators, power sources	Rotary generators, rotary convertors, batteries, power source equipment, oscillators, crystal oscillators
H	Signal devices	Light and sound indicators
J	--	
K	Relays, contacts	
L	Inductors	Induction coils, line filters
M	Electric motors	
N	--	
P	Measuring equipment, testing equipment	Indicators, recording and integrating measurement equipment, signal sounders, clocks
Q	Mechanical switching devices in power grids	Breakers, isolation switches
R	Resistors	Variable resistors, potentiometers, rheostats, shunts, thermistors
S	Switches, selectors	Control switches, buttons, limit switches, selectors, contact selectors, connectors
T	Transformers	Power transformers, current transformers
U	Modulators, transducers	Frequency discriminators, paramodulators, frequency transformers, encoders, phase inverters, transcoders, telegraph decoders
V	Vacuum tubes, semiconductors	Vacuum tubes, gas discharge tubes, diodes, transistors, thyratron crystal tubes (silicon controlled rectifiers)
W	Transmission channels, waveguides (tubes), antennas	Bridles, cables, bus-bars, waveguide tubes, waveguide directional couplers, dipole wires, parabolic antennas
X	Terminals, plugs, sockets	Isolation plugs and sockets, test plugs, terminal boards, solder connection terminal boards

Table 1 (Cont)

Letter Code	Type of Item	Examples
Y	Electrically-operated machinery and equipment	Brakes, clutches, air valves
Z	Terminal equipment, mixed transformers, filters, equalizers, amplitude limiters	Cable balancing networks, compressor-expandors, crystal filters

Table 2. Letter Codes and the General Uses They Represent (For Use in Segment 3C)

Letter Code	General Use
A	Auxiliary
B	Direction of movement (forward, backward, up, down, clock-wise, counter clock-wise)
C	Counting
D	Differential motion
E	--
F	Safeguards
G	Testing
H	Signals
J	Integration
K	Dynamic
L	--
M	Main
N	Measurement
P	Proportion
Q	State (start, stop, limit)
R	Reset, eliminate
S	Storage, recording
T	Timing, delay
U	--
V	Velocity (acceleration, braking)
W	Addition
X	Multiplication
Y	Simulation
Z	Numerals

[No 3, 1984 pp 17-24]

[Text]

PART TWO

2.1.2 The Drawing of Connection Diagrams and Tables

These standards are suitable for use in electrotechnological connection diagrams and tables.

A. The purpose of connection diagrams and tables:

Connection diagrams and tables provide detailed information on the external connecting lines of equipment and components needed for connection lines, in order to facilitate wiring and safeguards. The internal connections and information on equipment and components are usually not included, but they should be provided when connections need to be made.

Connection diagrams and tables can be used in combination if they contain clear representations. Tables should be used when there are large numbers of connecting wires.

B. The connection diagram illustration method:

The standards stipulate that the item codes and the actual information and data related to the connecting lines of each piece of equipment or component should be shown when drawing connection diagrams.

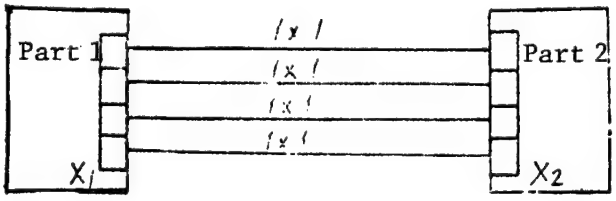
Arrangement:

Each piece of equipment and component should be represented with straight lines and simple outlines (square, circular or rectangular). Great efforts should be made in arranging them to express the actual layout of the equipment and components. Each piece of equipment, component and connector (such as connecting plates, sockets, plugs, etc) should have a symbol or item code, and there should be clear symbols for the connectors or connector terminals. If the actual position of some of the terminals or connectors or equipment or components is unclear, there should be full information on the interconnections on the location diagram.

Types of connection diagrams:

1) Each single wire between equipment and components can be differentiated and represented by a separate line (see Figure 17).

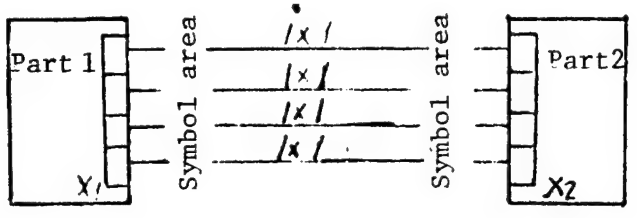
Figure 17.



Note: 1 x 1 refers to one 1 mm^2-line.

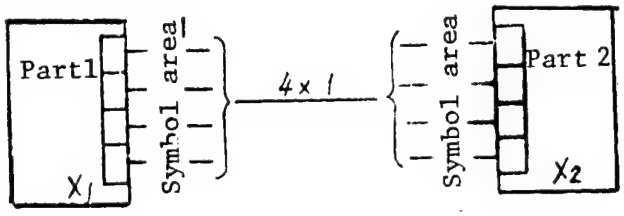
2) In order to include symbols or data, the ends of each wire can be separated by a short distance, but the lines between them should be represented by solid lines (see Figure 18).

Figure 18.



3) When they have the same termination, the many lines inside can be represented with a single line (see Figure 19).

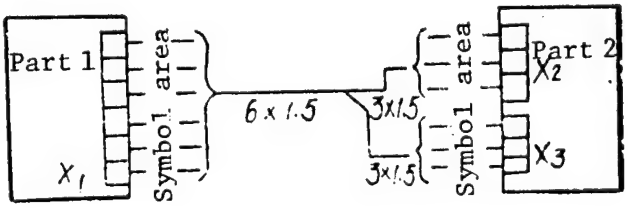
Figure 19.



Note: 4 x 4 refers to four 1 mm^2 lines.

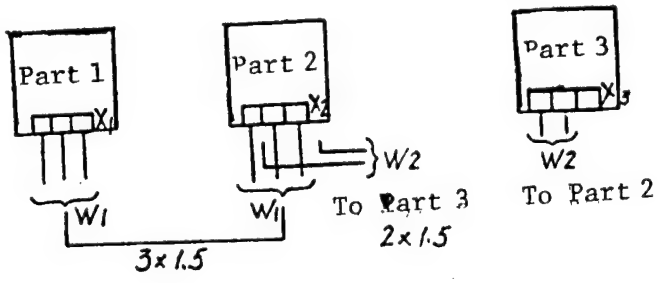
4) If there is a single starting and but more than one termination, the lines can be represented separately near the termination (see Figure 20).

Figure 20.



5) If each of the corresponding ends are clearly marked, then the long section of the line between them can be omitted (see Figure 21).

Figure 21.



6) Cables or insulated multicore cables should be represented by a single line.

C. The tabular representation method:

The tabular representation method is most suitable when there are many connections. The details of tabular representations should be determined by actual conditions, but there should be complete data on each connection point and on wires and cables. Diagrams should be drawn for any information that cannot be represented clearly in a table (such as the position of equipment and components, etc).

2.1.3 The Drawing of Equipment Wiring Diagrams and Tables

This standard is suited for use in equipment wiring diagrams and tables for electronic equipment. Printed circuits are not included.

A. The purpose of equipment wiring diagrams and tables:

Equipment wiring diagrams and tables provide information on the internal electrical connections of equipment components or modules. They are used primarily in manufacturing and maintenance. The external connections of equipment components are usually not included, but they can serve as a reference for the corresponding external connection diagram and table.

Equipment wiring diagrams and tables can be used together, or either can contain additional related information (such as work diagrams, circuit diagrams, tables of components, etc).

B. Methods of representing equipment wiring diagrams:

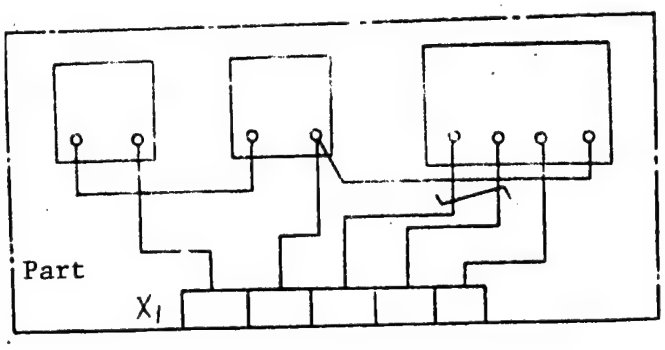
Layout:

Generally, they should be drawn according to approximate actual positions. Visual diagrams should be selected so that they most clearly display the terminations or wiring of every module or component. There should be additional visual diagrams when the illustration in a visual diagram is unclear. When components or parts overlap in several layers, the flip-page or offset method can be used to represent the terminations of the components and parts on the diagram. The modules on internal connection diagrams should be represented by single lines or simple outlines (square, round or rectangular). At times, they also can be represented with graphic symbols. They also should be shown on machine drawings if they are needed during installation. Terminations can be represented with graphic symbols, and there can be explanations of whether or not the connection can be disassembled.

Types of wiring diagrams:

1) When the connections are simple, the connections between components and equipment can be represented by a single line (as in Figure 22).

Figure 22.

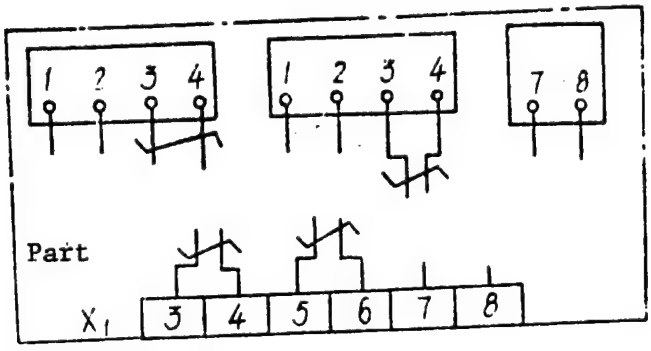


Note: X1 refers to a terminal, ≠ means two connecting wires

2) A common single line can be used to represent grouped lines, cables or cable lines. If there are several wire groups within a single piece of equipment or component (cables, cable lines, etc), then they should be separated clearly (distinguished by group or by using different colors, and the lines for each of the wires connected with the cable should be numbered).

3) If the terminations are marked clearly, the broken line method can be used (see Figure 23).

Figure 23.



The tabular representation method:

Tabular representations can be used in euqipment wiring diagrams. Tabular representations are more appropriate than wiring diagrams in some cases. The actual detail of the tabular representation should be determined by concrete conditions. The related diagrams (such as location diagrams, etc) should be attached when using tabular representations.

In order to facilitate understanding of the connection diagrams and wiring diagrams described above, there should be suitable revisions of the example diagrams drawn according to the standards (Figures 17 to 22 were drawn after revision).

2.2 Examples of the Content of the Various Technical Documents for Electrical Equipment Used in Machine Tools

The technical documents that should be provided for the electrical equipment used in machine tools were introduced above. Below, we will discuss the content of each technical document (charts, tables, instructions, etc) and how to apply the standards formulated by the TC3 (graphic symbols), TC16 (wire termination symbols and other symbols) and other technical committees, as well as the diagrams, tables and explanations of the TC44 Technical Committee (electrical equipment used in industrial machinery) based on the actual conditions of the electrical equipment used in machine tools.

The examples described here are taken from three standards: the third supplement to 204-1C (1975), Appendix E, diagrams, tables and explanations; the fourth supplement of 204-1D (1979), Appendix F, symbols for electrical equipment used in industrial machinery; and the first supplement 204-3A (1979) and Appendix E, illustrations of the electrical equipment used in industrial machinery.

A. Symbols for the electrical equipment used in industrial machinery (symbolic representation of components):

The standards for the item codes for equipment have been determined by the "TC3" technical committee (see Table 1 in Part One, "Letter Codes for Item Names by Type"). All of the letter codes shown in Table 1 are single letters. However, it is also pointed out in the standards that two or more letters can be combined if a single letter item code (Part 3A) makes it difficult to distinguish the type of component. Based on this decision, the "TC44" technical committee has added a single letter (for some, not all, components) to make a two-letter code. For this reason, they formulated the "Symbolic Representation Methods for Electrical Equipment Used in Industrial Machinery", as shown in Table 3, "Letter Symbols for Component Types".

The content of the first and second columns in Table 3 is identical to the corresponding column in the "Letter Codes for Item Names by Type" formulated by "TC3", except that a column has been added in the middle for the component symbols (codes).

Table 3. Letter Symbols For the Names of Parts by Type

Letter Code (as in Publication 113-2)	Type of Part	Examples	Part Symbol
1	2	3	4
A	Module, block	Lasers Microwave lasers Regulators	A
		Transistor amplifiers	AD
		Integrated circuit amplifiers	AJ
		Magnetic amplifiers	AM
		Vacuum tube amplifiers	AV
		Printed circuits	AP
		Drawers	AT
		Stands	AR
B	Non-coulometric -coulometric or coulometric-non-coulometric sensors	Photocells, dynamometers, quartz sensors, magaphones, pickups, speakers, synchronous solvers	B
		Simulators and multi-stage numerical sensors (used for indicators and measurement):	
		Pressure sensors	BP
		Locational sensors	BQ
		Rotary sensors (speed-sensing generators)	BR
		Temperature sensors	BT
		Speed sensors	BV
C	Capacitors		C
D	Binary components	Integrated components Delay lines	D
	Time-delay devices	Bistable components Monostable components	
	Memory devices	Registers Core Memory Magnetic tape or disk recorders	
E	Other components	Components not specified elsewhere in this table	E
		Heating components	EH
		Light bulbs	EL
		Air conditioners	EV
F	Protection devices	Overvoltage discharge devices, brakes	F
		Current protection devices with instantaneous operation	FA
		Current protection devices with time-delay operation	FR

Table 3 (Cont)

		Current protection devices with time-delay and instantaneous operation	FS
		Fusible protection devices	FU
		Voltage limiting protection devices	FV
G	Generators	Rotary generators, (quartz) oscillators	G
		Storage batteries	GB
		Rotary or stationary converters	GF
		Power source devices	GS
H	Signal devices	Sound signals	HA
		Light signals, indicator lamps	HL
J			
K	Relays	Instantaneous contact relays	KA
	Contacts	Instantaneous make-break relays Latching contact relays (with mechanical latches or permanent magnets) Bistable relays	KL
		Contacts	KM
		Polarized relays	KP
		Reed relays	KR
		Relays with or without time delays	KT
L	Inductors	Induction coils, circuit filters	L
M	Electric motors		M
N			
P	Measurement devices, test equipment	Indicators, recorders, integrated measurement devices, signal producers	P
		Ammeters	PA
		Pulse counters	PC
		Kilowatt-hour meters	PJ
		Recording devices	PS
		Timers, operating time clocks	PT
		Voltmeters	PV
Q	Power circuit mechanical switching devices	Breakers	QF
		Electric motor protection switches	QM
		Cutoff switches	QS
R	Resistors	Fixed and variable resistors	R
		Potentiometers	RP
		Measuring current dividers	RS
		Temperature-variable resistors	RT
		Voltage-variable resistors	RV
S	Control, recording, signalling and other switches	Selector switches or control switches	SA
		Buttons (including electronic proximity detectors)	SB
		Mechanical or electronic, with or without sensors:	
		Liquid datum mark sensors	SL
		Pressure sensors	SP

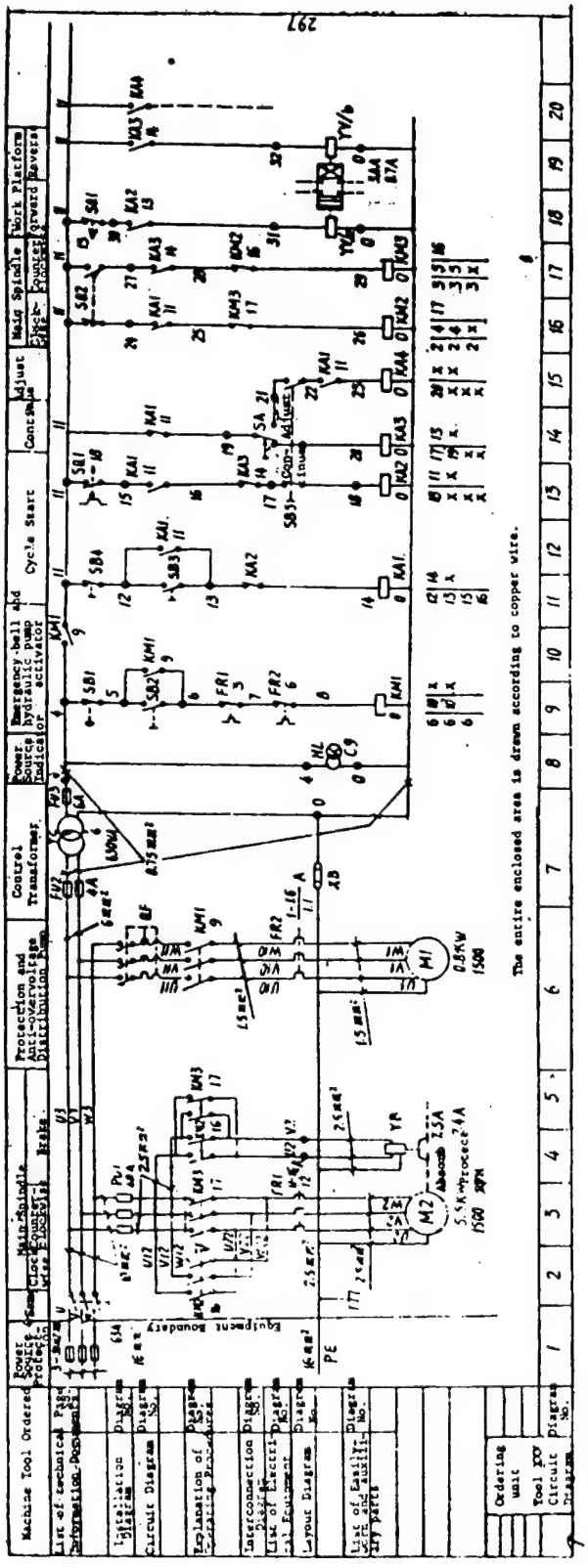
Table 3 (Cont)

		Proximity sensors	SQ
		Revolution sensors	SR
		Temperature sensors	ST
T	Transformers	Current mutual inductors	TA
		Control circuit power source transformers	TC
		Power transformers	TM
		Magnetic stabilization transformers	TS
		Voltage transformers	TV
U	Modulators, convertors	Discriminators, demodulators, frequency convertors, encoders, convertors, inverse transformers, phase convertors, telegram decoders	U
V	Vacuum tubes, semiconductors	Vacuum tubes, gas discharge tubes, diodes, transistors, thyristors	V
		Bridge rectifiers used in control circuits and power sources	VC
W	Feeders, waveguide tubes	Cross-connectors, cables, bus-bars, waveguide tubes, waveguide directional couplings, dipole and parabolic antennas	W
X	Connector sockets	Coupling lines	XB
		Test plugs	XJ
	Plugs	Plugs	XP
		Sockets	XS
	Sockets	Connector terminal boards	XT
Y	Electrically-powered machinery and components	Electromagnets	YA
		Electromagnetic brakes	YB
		Electromagnetic clutches	YC
		Electromagnetic cards and disks	YH
		Electromagnetic valves	YV
Z	Terminal equipment, Mixed transformers, filters, compensators, limiters	Cable balancing circuits, compressors	Z
		Crystal filters	

3. Examples of circuit diagrams:

Looking at examples of circuit diagrams provided in the standards, the components can be divided into two groups. One group concerns relay-contact control systems. The other type is electronic equipment. The diagram types can be divided into vertical or horizontal diagrams. The method for specifying the location of components also can be divided into reference grid systems, circuit symbol systems, and so on. Regardless of the number of example diagrams provided, there still are only a limited number of examples, and there are no mandatory ones. The standards also point out that any illustration method proposed by the "TC3" Technical Committee can be used to design circuit diagrams. There also are many different programs of the "TC3" in the area of methods for illustrating circuit diagrams. Therefore, the circuit diagram examples issued by the "TC44" Technical Committee cannot be used in their entirety. Because of publication limitations, this article cannot provide every example. We can only offer examples of those circuit diagrams that are in fairly common use in the electrical equipment used in machine tools at present and the relay-contact control systems that are related to the new electrical standards that we implemented in 1984, so that the related comrades can understand the IEC requirements for the content and method of representation of circuit diagrams for machine tools. To simplify the illustrations, the circuit diagram provided here has undergone simplification (see Figure 24).

Figure 24.


Machine Tool Ordered
Power Supply Circuit Protection
Main Spindle
Control Transformer
Protection and Anti-overvoltage Distribution Box
Power Source Indicator
Emergency bell and hydraulic pump motor activator
Cycle Start
Control Panel
Adjust
Main Spindle
Work Platform
List of Technical Information Documents
Installation Diagram
Circuit Diagram
Explanation of Operating Procedure
Interconnection Diagram
List of Electrical Equipment
Layout Diagram
List of Easily Worn and Spare Parts
Ordering unit
Tool No.
Circuit Diagram No.
Manufacturing plant name
Equipment Boundary
The entire enclosed area is drawn according to copper wire.
297

The standards contain the following explanations of the circuit diagram:

1. The circuit diagram is drawn vertically and connects with a horizontally-drawn power source. The power circuit is represented with multiple wires (multiphase).

2. The component symbols (codes) are specified in Table 3.

3. Simple common symbols are used in the circuit diagram, and notes should be added when they need to be clearly distinguished.

4. The components are drawn using the decentralized representation method.

5. In the starting position (the position before the machine tool begins moving), when the throw switch is depressed, a "gyro wheel" symbol should be added (e.g., SQ1).

6. A list of all the technical documents for electrical equipment can be attached to the circuit diagram (see the "List of Technical Information Documents" at the left of the circuit diagram in Figure 24).

7. The various components drawn on a circuit diagram explain the uses of different symbols, and for this reason they do not conform to principles of action and the related technical requirements.

8. The table below the electromagnetic component coils with contacts specifies that there should be three rows of connectors and two rows of relays.

8a. Connectors: the left column gives the circuit number of the primary contact. The middle column is for the auxiliary normally open contact, while the right column has the circuit number of the auxiliary normally closed contact.

8b. Relays: the left column has the circuit number of the normally open contact, while the right column has the circuit number of the normally closed contact.

Unused contacts are marked with an "X".

9. Electromagnetic components with contacts have the circuit number of the coil of the contact shown as a number below the contact.

10. Signal lamp and associated transformer are drawn together because they are equivalent to voltage control.

11. The C9 below the indicator lamp refers to the color of the lense. C9 means white.

12. The letters "PE" in the diagram refer to the "protection wire".

13. The large black dots refer to passage through the terminal board, while the small black dots refer to internal connection points that do not pass through the terminal board.

It can be seen from the diagram that the components in the "Circuit Symbol System" of the "TC3" (with the lower portion indicating circuit numbers and the upper portion showing circuit functions) were drawn using the "decentralized representation method". The item codes were drawn using the alphabetical codes from the table of "Letter Codes for Names of Tunes of Items", except that an additional letter has been added for some components. The circuit diagram was drawn on 297-mm-wide paper. The diagram should show the sectional area of each wire and the related technical data should be provided for certain of the components such as fuses, arresters, electromagnetic valves, etc).

C. Examples of operations procedures explanations:

This portion of the standards has three parts:

1) Diagrams of the transmission system of moving parts.

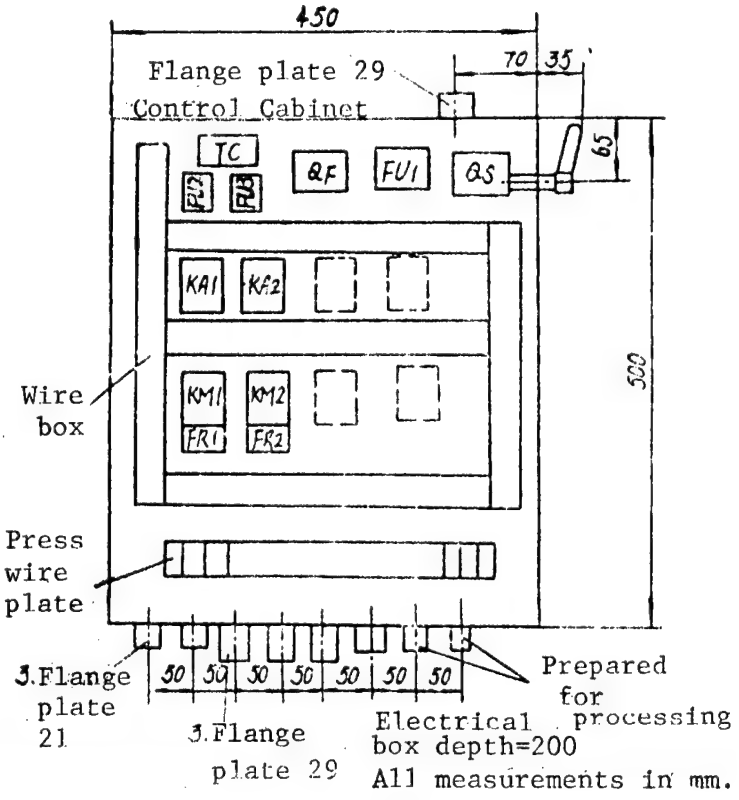
2) Illustrations of work cycles (the switch codes for each changeover condition).

3) Explanations of operational procedures, a verbal description of all of the operating conditions of the entire machine tool. It should also include the resetting of switch positions under each type of condition, and so on.

D. Examples of location diagrams:

A location diagram shows the relative positions of the electrical parts and apparatus in the control cabinet (see Figure 25). This diagram is only an example for the purposes of making it easier to understand what the diagram should show. Thus, it does not match the circuit diagram drawn above.

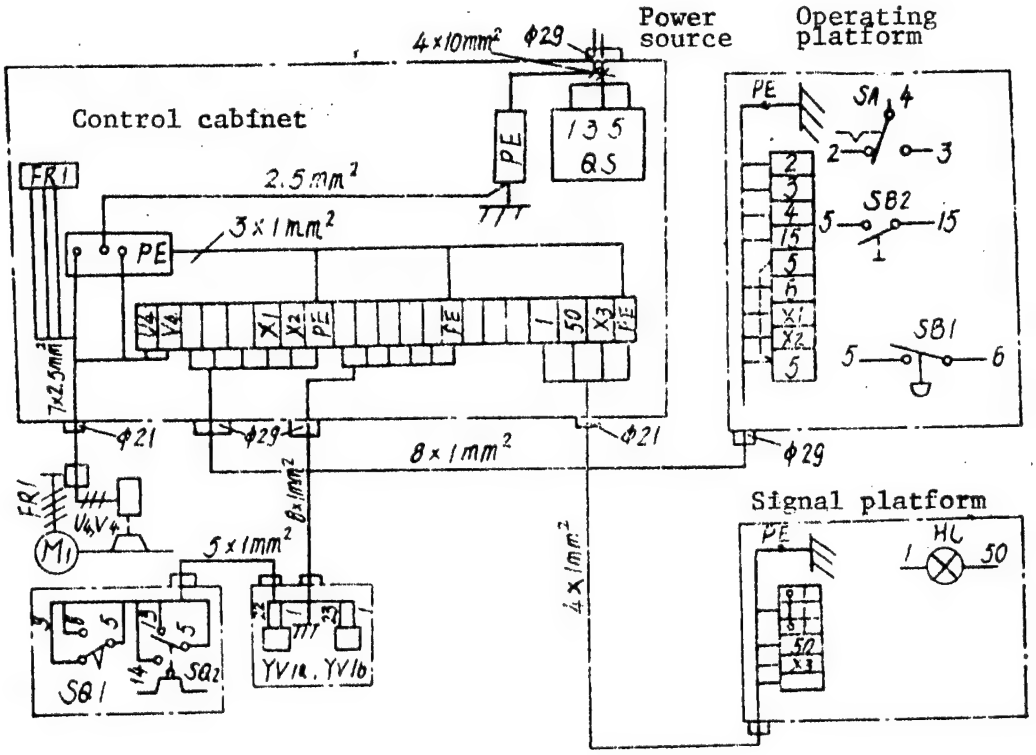
Figure 25.



E. An example of an interconnection diagram:

The diagram provided in the standards illustrates the connections of the various parts of the control cabinet (such as the operating platform, signal platform, etc) along the machine tool (see Figure 26). The connections shown in the diagram are only examples to show what connections should be included. This diagram also is a simplified version of the original one, so it does not match the circuit diagram that was drawn. In addition, the parts of each component and the number of wires on the connector board do not necessarily match. The connections on the connector board that are used are marked with an "X", followed by numbers showing the number that are used.

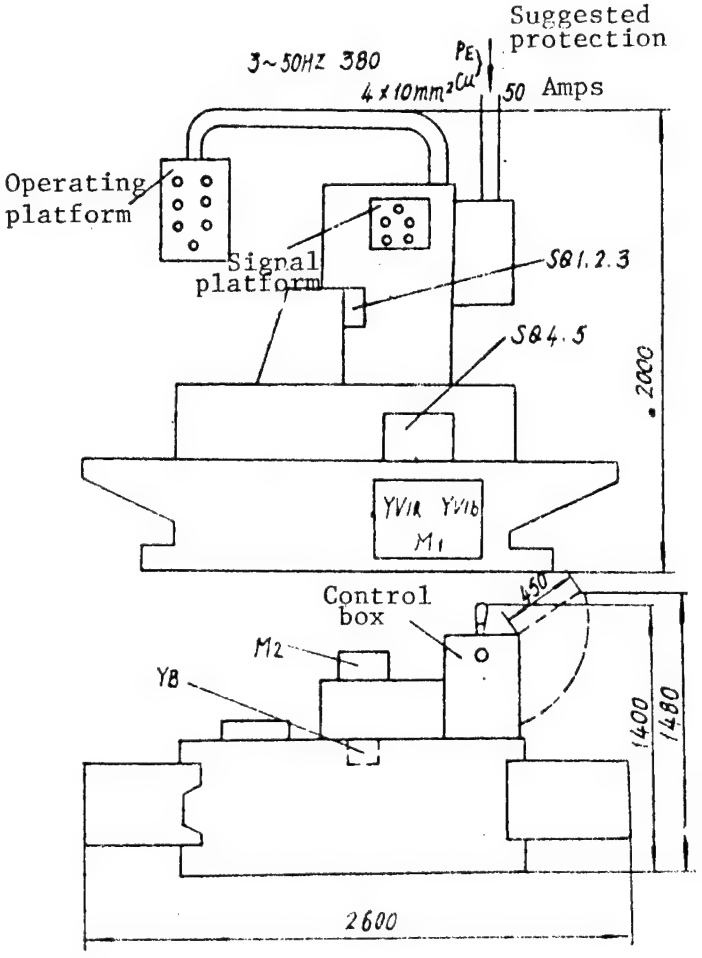
Figure 26.



F. Examples of installation diagrams:

Installation diagrams show the electrical machines, electrical components, operations platform, signal platform, control cabinet, electromagnetic valves and other parts of the machine tool. Their relative position is also shown. The measurements of the configuration and the smallest measurements needed for opening the control cabinet door should also be shown. The number of phases, type of current, frequency, voltage, required sectional area of wires and the recommended current values for fuses should be shown where the power source line enters the control cabinet (see Figure 27). This diagram also is only an example, and does not completely match the components in the circuit diagram that was introduced previously. It is merely a suggestion of the content of the notes.

Figure 27.



G. Examples of lists of electrical equipment:

A list of electrical equipment is a long table, as shown in Table 4. Looking at the overall content of this long table, it should list buttons, selector switches, relays, contacts, overload relays, limit switches, fuses, connector plates, indicator lights (socket, bulbs and shades), electric brake of the main spindle, electromagnetic valves, power switches, breakers, transformers and other electrical machinery.

Table 4. An Electrical Equipment List

Machine Tool XXX			See Circuit Diagram XXX for Reference				
Component Symbol	Circuit Number	Explanation and Uses	Technical Data	Number	Supplier Reference	Supplier	Notes
SB2	9	Button, hydraulic pump	Normally open, normally closed, 1 of each	1	XXX	XXX	
etc	etc	etc	etc	etc	etc	etc	

H. Examples of lists of easily-worn parts and auxiliary parts:

The standards permit a single table to be used to show easily-worn parts and auxiliary parts (see Table 5).

The table includes: brakes, electromagnetic valves, safety devices, limit switches, relays, and so on.

Table 5. List of Easily-worn and Auxiliary Components

Machine Tool XXX		See List				
Component Symbol	Explanation	Technical Data	Number	Supplier Reference	Supplier	Notes
FU1	Fuse holder 22 x 58	40A	3	XXX	XXX	
etc	etc	etc	etc	etc	etc	

III. Conclusion

The first part of this article provides a brief description of the process of development and change in the standardization of electrical equipment used in machine tools since the founding of the nation, as well the standards for electrical equipment used in machine tools that have been published up to now or that are now being formulated. The second summarizes the overall situation at the International Electrotechnical Commission and the already-published standards of the IEC's TC3 Technical Committee concerning electrical equipment used in machine tools and the standards of the TC44 Technical Committee related to electrical equipment used in machine tools. In addition, it also provided examples of the commonly used relay-contact systems in electrical equipment used in machine tools to describe the technical documents and their content that should be provided for the electrical equipment used in each machine tool.

The author hopes that the simple introduction provided by this article will enable the comrades involved in the design, manufacture and maintenance of the electrical equipment used in machine tools to understand the IEC standards concerning electrical equipment used in machine tools, and that it will serve as a reference for the implementation of the standards concerning electrical equipment used in machine tools that have been formulated in China.

References

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2. Translated Documents on Publications of the International Electrotechnical Commission, TC16 Wire Terminal Symbols and Other Symbols, Standardization Office of the First Ministry of Machine Building, 1981.

3. International Electrotechnical Commission (IEC Standards), Electrical Equipment Used in Machine Tools (Drafting Standards), Machine Tools Research Institute, First Ministry of Machine Building, 1981.

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CSO: 4008/268

ALL-ARMY SYMPOSIUM ON PATHOLOGY

Beijing JIEFANGJUN YIXUE ZAZHI [MEDICAL JOURNAL OF CHINESE PEOPLE'S LIBERATION ARMY] in Chinese No 4, Aug 83 pp 306-308

[Article by Shi Jingquan [0670 2529 3123] and Chen Yisheng [7115 1942 3932]: "Summary of Papers Presented to the Second All-Army Symposium on Pathology"]

[Excerpts] The Second All-Army Symposium on Pathology was convened at the Third Military Medical College, Chongqing, 21-25 March 1983. Four hundred scholarly papers were received by the symposium, among which 37 were read in the general meeting and 70 were discussed in group meetings. There was much improvement in both the quality and quantity of the papers over those presented at the previous symposium. A very broad range of subjects was covered, with military medical science occupying a considerable proportion. The symposium reflected the scholarly achievement and new progress in military pathology.

War Wound Pathology--This subject covered radioactive injuries, burns, combination wounds, firearm wounds, decompression sickness, etc. The Military Medical Science Academy has observed radiation sickness of brain, intestine and marrow types in dogs caused by nuclear tests and different doses of laboratory irradiation. The pathological changes in the central nervous systems were seen as having notable differences. It was recommended that brain radiation diseases be put into three categories: cerebellum type, total-brain type I and total-brain type II. In Hospital 307, different doses of ^{60}Co γ-rays were used to irradiate small mice. Changes in the small-intestine mucous membrane were recorded. Within the 48-hour injury period after irradiation, the process of cell splitting decreased, then disappeared. Crypt cells were reduced, causing crypt atrophy. With the increase in radiation dose, the crypt size shrank and the number of cells diminished notably. During the recovery period, the increase in both the size of the crypt and the number of cells was more than the normal value to compensate for the loss. The General Logistics Department's Medical College and other units have studied the movements of the small-intestine villi cells in mice and the effect of radiation on them. It was discovered that ionizing radiation can slow down the movement of the intestine villus cells. The application of the WR-2721 radiation protection drug before irradiation can reduce the

movement of the villi, thus accelerating the recovery of the pool of functions. Finding the speed of villus epithelial cell movement provides a rather good indicator for research on radiation disease of the intestinal type, its laws of injury and recovery, drugs for radiation protection, and their evaluation. Research on the effect of ionizing radiation and other factors on the multiplication of enteromycoderm cell groups was a significant study. The Third Military Medical College conducted a more systematic study on peripheral burns and compound injuries. A prominent problem in serious respiratory tract burns by steam has been pulmontary edema in the early stage. Observations of wounded animals (dogs) by electron microscope have shown that there is edema in the lung blood capillary endothelium cells and in lung air sac type-I epithelium, resulting in necrosis and exposing the basement membrane. For air sac type-II epithelium edema, large air sacs were formed and lamellar entities decreased. Such changes constitute the morphological foundation of pulmonary edema. Observations by optical microscope have shown conspicuous differences between the experimental group and the control group of granulation-shedding mast cells in tracheal and bronchail walls. The increase of tissue amine in conjugated blood indicated that the occurrence of early-stage pulmonary edema was partly the direct result of the heat and partly related to the increase in the penetrability of the blood vessel walls as caused by the emitting of tissue amine due to the granulation shedding of the mast cells. Some major early heart pathological changes caused by severe respiratory trace burns are: edema in the heart muscle cells and in interstitial locations, expansion of ji jiang wang [5133 3364 4986] caused by the dissolving of focal heart muscle fibers and the degeneration of chondriosome and a decrease of the activity of the succinodehydrogenase of the heart muscle, as caused by both the injury of burns and the increase of tissue amine in the blood. Observations in the histology of kidney specimen and ultrastructural organization of 17 cases of burns revealed the pathological changes in both renal tubules and glomerulus--the widening of xi mo qu [4762 5229 0575], the increase in number and enlargement of ximo [4762 5229] cells, the swelling of endothelium cells and the blood deficiency in glomerulus blood capillary caused by the crowding of white cells in the blood capillary cavity generally called "acute glomerulus pathological change." Since the half-quantitative intergral of the glomerulus pathological change was positively correlated with the existence of blood urea nitrogen and blood creatinine content, the major reason for the blood deficiency of glomerulus among many other factors hindering kidney functions is the acute glomerulus pathological change. Injury to renal tubules is the next important factor. Pathological-change research on large-rat radiation injuries, burns and combination wounds of both radiation injuries and other wounds studied the changes in ming liang [2494 0081] cells and zhimi [5268 1378] cells, and the chemical foundation of the cells in particular and presented the reasonf of the occurrence and the significance in "oxyphil cell pieces," "baojiang san luo [5165 3364 2414 5507]" and "cells into sinus," etc. These changes have definite phases and distribution characteristics. It was also discovered that the combined effect of radiation and burn injuries on the adrenal cortex are different from that in the general body or in

other organ tissues. Resting on a previous research basis, the Third Military Medical College emphasizes the use of electron microscope observations to confirm the "the phenomenon of marrow macronucleus cells being swallowed up." The developing procedure for granulocyte entering into macronucleus cells and the three styles through which granulocyte brings into full play the function of phagocytose inside the macronucleus cells. To be specific, the granulocyte swallowed components of macronucleus cells to form entities resulting from the swallowing act, emit lososome and emit whole grains of lysosome. Such changes in the macronucleus cells is the main reason for the decrease in the thrombocyte number during burns and collision wounds and the bination wounds of collisions and burns. One of the major paths for the disappearance of macronucleus cells from bone marrows was their being swallowed up by granulocyte after degeneration. Acting as the small phagocyte, the neuter granulocyte also participated in the reaction or the organism's swallowing of its own cells. In the field of chemical injuries, the Fourth Military Medical College did laboratory research on chronic poisoning by diphosgene. The electron microscope has shown the retromorphosis in the air sac type-I epithelium of domestic rabbits and small mice and the notable increase in type-II epithelium. Increased growth in air sac ge [7133] collagen fibers, swollenness and a decrease in the adaptive function of blood capillaries were also observed. Coloring the lung tissue section with anti-γ-globulin and anti-IgG florescent antibodies, they discovered strip-shape irregular pieces of flourescent positive matters deposited in the lung air sacs ge jianzhi nei [7133 7035 6347 0355], small bronchial walls and small vessel walls and their surrounding tissues. A positive reaction to anti-C_3 flourescent antibodies was revealed in the above locations. The researchers suggested that the positive matters possibly were immune complex. Repeated diphasgene poisoning caused small mice to produce chronic endurance to diphosgene. The researchers regarded chronic respiratory tract infection and the thickening of the air-blood protective screen structure as one reason for forming the endurance. In firearm wounds, the First Military Medical College has observed 39 incidents of pathological changes in 34 cases of firearm wounds which resulted in the excision of surrounding nerves. A majority of nerve foci has perineurium damages, scars and nerve tumors caused by injury. Chronic inflammations of various degrees have also been observed. In addition, 32 cases of nerve injuries in the four limbs together with nerve tumors caused by injury have been observed using optical microscopes and electron microscopes (3 cases) to analyze through morphological changes the damage to perineurium protective screen functions which was caused by injury and by the newly proliferated axon buds which grew into the mesenchym because of the loss of the protective screen, and the process nerve tumors were formed due to injuries. Pathomorphological observations on the wounds of canine soft tissues, caused by two different kinds of bullets at different times, were conducted in the Third Military Medical College. Basic pathological changes of the two kinds of bullet wounds are alike. The only difference is that the wound caused by the 5.56-mm bullet, which is faster, inflicted a larger wound track than the 7.62-mm bullet. The damage to the tissues caused by the 5.56-mm bullet was more severe. The ratio of the two largest circumference paths was 3:1. The scope of the

bruise area as determined by microscope examination was smaller than that determined by general estimate, the ratio being 1:2.5. At the Naval Medical Research Institute, experimental research found that the pathological changes of the acute decompression sickness as caused by fast floating were mainly due to large-scale air embolism, agglutination of blood cells and condensation of blood. Lung barotrauma and fat emboli have not been discovered so far. This is different from the general changes in pathological histology on decompression sickness. The reason can be traced to the short exposure time before rapid floating under high barometric pressure. Since the tissues (e.g., blood, lympatic fluid), whose half-saturation time is short, have in them the presence of a certain amount of overly saturated inertia gases, and since those tissues whose half-saturation time is long have not yet been able to oversaturate the inertia gases, no air sacs are being produced during rapid decompression. The discovery not only proved that half-saturated tissues are different but also provided reference material for the compression plan in treating rapid floating decompression sickness.

Digestive System Pathology--Concerning research in chronic gastritis and gastric cancer, the Fourth Military Medical College, Hospital 206 and Hospital 322 have explored the pathological diagnosis standard of elementary gastritis and atrophic gastritis and discovered that the degree and occurrence rate of intestinal change have a tendency to increase and become more severe with the increase in age. The Third Military Medical College presented the research concerning the chemical changes in the mucous-membrane epithelium mucus tissues in chronic gastritis. In chronic gastritis, there is confusion in the secretion of the mucous-membrane epithelium. There is a close relationship between the appearance of sulphate mucus and cancer. The Army Units General Hospital, the Second Military Medical College, Hospital 97 and Hospital 208 did pathological research in gastric cancer and explored the following: (1) pathological types in gastric cancer, (2) the method and standard for diagnosing gastric cancer using gastric mucous-membrane biopsy with suggestions for using the "three five-level infiltration classification" method, (3) the distinction between early gastric cancer and atypical proliferation, (4) morphological changes in late stage gastric cancer and (5) the relationship between the histological typing of gastric cancer, mesenchyme inflammatory reaction and prognosis.

The research in hepatitis, hepatocirrhosis and hepatic cancer is more thorough-going. Through the ultrastructural research on chronic virus hepatitis, the Army Units General Hospital in Nanjing has discovered the following: (1) During chronic hepatitis, the hepatic cell junctural space is significantly widened; many microvilli point toward the space, which is named the pseudo-Disse's space. (2) The space surrounding the hepatic sinus is widened. (3) There is an increase in Ito cells (lipid accumulation in cells) and the production of large numbers of collagen fibers. The change of pseudo-Disse's space of hepatic cell surfaces and the invasion of collagen are the more characteristic pathological changes of the type-B chronic hepatitis. The overly active Ito cell function produced large numbers of collagen fibers to fill the Disse's

space and obstruct the junctural surface of hepatic cells, constituting an important factor for developing hepatocirrhosis. The Third Military Medical College suggested two categories for serious hepatitis: acute hepatic necrosis-chronic hepatic diseases group (hepatic atrophic group) and the chronic and active group (hepatic enlargement group). Hepatic atrophic group is subdivided into four clinical pathological types (Type I, Type II, Type III and Type IV). The types do overlap, yet they each have pathological-change characteristics. Thus, the types can reflect the various stages of the pathological changes from one stage to another in the process of changing from subacute hepatic necrosis to hepatocirrhosis. The transfer between necrosis and multiplication of the hepatic substance is the important mechanism for the clinical onset and the slowdown of the process of moving from subacute hepatitis toward hepatocirrhosis. The Nanjing Army Units General Hospital did histology and ultra-structural research on 80 cases of HBsAg carriers who did not have symptoms through hepatocentesis biopsy. The pathological changes are largely chronic delayed hepatitis. A small number are chronic active hepatitis. The hepatitis-B surface antigen-carrying state is largely chronic hepatitis with a progressive potential which is worth noticing in clinical pathology. Nanjing Army Units General Hospital, Guangzhou Army Units Pathological Associate Group, Hospital 254, Hospital 177 and Hospital 155 have studied the discovery rate of HBsAg in the peripheral blood and the hepatic cells of hepatitis patients. The Nanjing Army Units General Hospital examined the HBsAg and Dane granulation in the peripheral blood of hepatitis patients using tachyphylaxis electron microscope. The result showed that the numbers of HBsAg granulation and Dane granulation discovered in "chronic qian [6692]" "chronic active h" or hepatitis hepatocirrhosis are not notably different. Our preliminary conclusion is that the infectiousness of all types of hepatitis is alike. The Fourth Military Medical College used shuang qiao [7175 2890] PAP method to study the IgG distribution in hepatic cancer and its surrounding tissues. Of the 133 cases of hepatic cander, 52 have positive IgG reaction (39.1 percent). Of the 52 cases of positive reaction, 43 have positive cancer tissue, 34 have positive cancerous hepatic-surrounding tissues and 24 cases have positive tissues in both. We figure that studies of the distribution of IgG in hepatic cancer and its surrounding tissues could lead to understanding the distribution of HBcAg and anti-HBc.
In a study of the correlation between the AFP and IgG of human hepatic cancer and its surrounding tissues together with the immune locating of the AFP and the IgG, the Second Military Medical College found that their distribution in hepatic cancer and in its surrounding tissues and their cell morphology have both similarities and differences. Most of the IgG under observation have stretches of widespread positiveness. The positive degrees in AFP and IgG are not parallel. In some positions the AFP is stronger while in others the IgG is stronger. A study of the albumin (HSA) and AFP positive-cell distribution in human hepatic cancer and its surrounding tissues has the following findings: (1) There is no definite rule of distribution; (2) the positive granulation of HSA and AFP are mainly distributed in the moderate-differentiation (II and III classes) cancerous hepatic cells; and (3) in different tissue pieces of the same case or even in the same tissue, the positive degrees of the HSA and AFP

are not parallel. Sometimes they have a tendency to form in inverse ratio. Hospital 177 and Hospital 208 from a clinical analysis of the hepatic cancer pathology and of the relationship between primary hepatic cancer pathomorphology and the AFP have discovered that the level of AFP present is related to the degree of cancer cell differentiation. The occurrence of cancer is closely related to hepatitis and hepatocirrhosis. It is thus necessary positively to prevent hepatitis B. In the Guangzhou Army Units General Hospital, a description is made of the morphology of the "anomaly multiplication of hepatic cells" with the observation that the occurrence rate of such an anomaly is very high in the tissues or the surrounding tissues of hepatitis, hepatocirrhosis and hepatic cancer. Such pathological changes precede the occurrence of hepatic cancer.

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PROGRESS IN PHYSIOLOGY OF SPECIAL ENVIRONMENTS

Beijing JIEFANGJUN YIXUE ZAZHI [MEDICAL JOURNAL OF CHINESE PEOPLE'S LIBERATION ARMY] in Chinese No 4, Aug 1983 pp 309-310

[Article by Liu Jingchang [0491 2529 2490], Naval Medical Research Institute]

[Text] In October 1982, a symposium on military navigation medical science, special environment physiology and high barometric pressure medical science was convened in Shanghai to communicate research developments in applied physiology, labor hygienics and high barometric pressure medical science under the various special environments of military navigation, diving, high barometric pressure, high altitude and airtightness. The famous physiologist, Prof Zhang Xiangtong, reported on the significance and the trends of developments in applied physiological research. The following is a summary of the report.

Physiological Functions in Diving Conditions

The Naval Medical Research Institute and other units jointly completed a 200 meter simulation based on the data obtained from the helium oxygen saturation Diving Medical Protection Research Institute. The simulation has systematically described certain experiences and related theories concerning great-depth helium oxygen saturation diving medical protection. Twenty-one deep-sea divers had stayed continuously for 53 hours under absolute atmospheric pressure (ATA) before being observed for various physiological and biochemical indicators. It was observed that a definite change had occurred in heart blood vessel functions under high barometric pressure. Twenty-four hours under a high barometric pressure could slow down the heart rate for 56.4 times in the before-pressure state to 49.5 times on an average, with a simultaneous occurrence of sinus arrhythmia. As the period for staying under pressure lengthens, the heart beat speed recovers to a certain extent. Nevertheless, the heart beat speed would again go down with any reduction in pressure. Stroke volume increased from 1119.5 ± 6.1 ml to 134.4 ± 6.8 ml. Since the heart rate slowed down, the cardiac output per minute basically stayed the same. Chest transmission volume reduced from 4.462 ± 0.209 L to 4.032 ± 0.143 L. The changes disappear 1-4 days after the pressure returns to normal. Under 21 ATA, the α index of EEG (left frontal part-left pars occipitalis)

dropped conspicuously from 90 percent to 82 percent (P 0.01). At the start of pressure reduction the α index is being returned to control value. The time-vital capacity of lung function showed a conspicuous difference when compared with normal control value. The maximum amount of ventilation (MVV) dropped 32 percent. The percentage of the largest amount of ventilation (MVV percentage) and the ratio of the largest amount of ventilation to body surface area (MVV/BSA) under 21 ATA when contrasted with normal pressure did not show any apparent difference. During a pressure drop, parameters rose up to where they were and showed no apparent difference when contrasted with the control value. Before adding pressure and after reducing pressure, the maximum expiration flow speed--the capacity curve as contrasted with the average value of occlusion amount of air--do not have any notable difference. The major factor which affects the respiratory function under high barometric pressure is the increased respiration resistance caused by the increase in air density. The resistance, in turn, caused the reduction in the amount of lund ventilation.

Under the influence of the 200-meter helium oxygen function, the auditory threshold shift generally did not exceed 5 decibels (db). The maximum individual threshold shift is between 7.5 and 10 db. Slight fatigue of the hearing organ appeared due to the noises in the cabin. After experiment, the pressure in the middle ear cavity changed from the original regular or negative state to the positive. The functions of the ear drums and ting gu lian [8126 7539 6969] movements have increased notably, indicating that the membranc tympani sheng shun zhi [5116 7311 0237] has increased compared with those before the experiment.

The biochemical changes in the blood and urine during saturation diving are the tendency for the free amino acid in serum to decrease. The total amount of free amino acid as emitted in the urine, both needed and unneeded, is reduced. The reduction is probably caused by the reduced intake and increased consumption of proteins and calories under high pressure, large amounts of perspiration and environmental stress. An experiment in vitamin saturation shows that the effect of exposure to hyperbarometric pressure on thiamine metabolism is relatively conspicuous. The amounts of 3-methyl histidine and oxyproline emitted in serum and urine did not change, which shows that the metabolism of muscle protein, structural protein and collagen protein is rather stable.

Under the 200-meter helium oxygen saturation diving condition, the immunity function did not change regardless of whether it is the percentage of T lymphocyte or the immunity function of T lymphocyte. Nor was there any apparent change in the immunoglobulin and C_3 amount. It was not reported in the document concerning the suppression function to the formation of antibodies by the gases of gao fen ya yang [7559 0433 1090 8638] and heliox.

Theory on Diving Decompression and Prevention of Decompression Sickness

The radical cure for decompression sickness is through compression treatment. How much pressure should be exerted and how long should the duration of the compression be? How are oxygen and other combined gases used during decompression? What are some supporting treatments such as the use of drug, high-pressure oxygen, etc., which could affect the compression treatment? In Navy Hospital 401, four cases of the treatment of the injury to the spinal cord caused by decompression sickness have used the complex treatment of compression, hyperbaric oxygen and clinical drug treatment and have achieved fine results. Shanghai jiu lao ju [2405 2318 1444] presented their experience in treating an incident of severe decompression sickness. It was recommended that if the first compression treatment were not effective, repeated compression treatment using pressures at 5-7 kgf/cm^2 and holding the pressure for a longer duration might help. Hyperbaric oxygen and clinical complex treatment have a definite effect on injuries to the spinal cord. One should not rely exclusively on compression treatment alone.

The Shanghai Yangpu Central Hospital presented the osteonecrosis condition caused by decompression. Among the 821 workers working under hyperbarometric pressure, 93 cases of osteonecrosis at various stages were discovered. The foci of discovery are often multiple in nature. The places are mostly the thigh bone or humerus. Damage to joints is relatively extensive too.

The Naval Medical Research Institute reported on their explorations in diving undertakings concerning the method for aclculating nitrogen fen ya [0433 1090]. They attempted to figure out an accurate quantitative method for the decompression calculation theory through improving the solving of nitrogen diffusion equations between blood and certain series and parallel-connection tissues. The preliminary-claculation results from this theory have demonstrated that for a safe decompression plan, data fell on the safe side of the theoretical decompression curve. All actual-incident points fell on the unsafe side of the curve.

Appraisal of Hyperbaric Oxygen for Treatment of CO Poisoning and Other Diseases

Using hyperbaric oxygen for treatment of CO poisoning is the most effective method. The affiliated Xinhua Hospital of the Shanghai Second Medical College gave a summary report on the situation and experience for using hyperbaric oxygen in the treatment of CO poisoning during 1966-1981. Of the total of 1,980 cases, 1,687 were acute and 293 were secondary. The pressure used for treatment was 1.6-3.0 ATA, mostly at 2.5 ATA. Oxygen was breathed in at different intervals with a total oxygen inhalation period of 60-120 minutes. For acute poisoning, treatment was given within 20 times, mostly at 5 to 7 times; for secondary cases, the general number of treatments is 30 to 50 times, supplemented by other measures as needed by the patient's condition. The recent acute CO poisoning cure rate is

91.2 percent; total effective rate is 96.7 percent, while the case fatality rate and the secondary rate are 2 percent and 3.4 percent, respectively. Some of the cases have been followed up for more than 2 years and the cure rate is 78 percent. Experience has shown that treatment should be started early and be given many times, if needed. Sometimes the H_bCO in blood still exists after many treatments. Recovery from abnormal EEG requires an even longer period. The treatment experience can be summarized as follows: (1) early treatment; (2) treatment should be thorough; terminating the treatment too early at the request from patients to gain consciousness sooner should be avoided; and the number of treatments should be decided on the basis of the H_bCO test, EEG examination and clinical symptoms. Generally, light poisoning needs to be treated 3 to 7 times; medium-degree poisoning needs to be treated 10 to 20 times, while severe poisoning needs to be treated 20 to 30 times, and secondary cases often require treatment of more than 30 times; (3) combination treatment plans should be adopted.

Hyperbaric oxygen treatment has good results on spinal cord diseases. Deficient blood in spinal cords, and damage caused by oxygen deficiency are the result of myelitis, inflammation of great blood vessels, arteria spinalis, external injuries of the spinal cords and spinal ya pozheng [1090 6612 4017], etc. Hyperbaric oxygen has the function of protecting and improving the spinal cord in the disease area.

The Workers' and Peasants' Hospital of the Shanghai Second Medical College introduced their experience in using hyperbaric oxygen in the treatment of central artery embolism of retina and in lifesaving measures for drowning. Navy Hospital 401 reported on the effect of hyperbaric oxygen used for treating coronary heart disease and cerebral thrombus caused by hardening of the arteries. The cure rate for cases with significant improvement is 59 percent. In the First Affiliated Hospital of the Second Military Medical College, of the 32 cases of derma angiitis being treated by hyperbaric oxygen, the effective rate has reached 93.8 percent.

Labor Health for Closed Air-tight Environment

Prolonged existence in an airtight environment naturally has adverse effects on human health. To monitor the presence and density of harmful gases in the air of the environment, the Naval Medical Research Institute and other units reported on the experiment results as determined by gas chromatography concerning the content of methylamine, dimethylamine, trimethylamine, acetone, ding tong [0002 7904], hydrocarbon, formaldehyde and acetaldehyde, etc. The permissible density for harmful gases in the air is being suggested. The Naval Medical Science Department of the Second Military Hospital reported on the water-soluble vitamin nutrition condition of submarine personnel during voyages and the appraisal of the food quality after a long period of storage. Such health studies not only have provided theoretical parameters for improving the nutrition condition and the environment of naval ships but also have practical significance. A submarine detachment reported on the effect of the special environment of submersion on the physiology of personnel with particular emphasis on analyzing the hindrance to digestive functions and to the motor system.

Altitude Physiology and Highland Practice Service

The Shanghai Institute of Physiology of the Chinese Academy of Sciences has observed and measured the physiological effects of "environmental compression" on 27 male workers at 4,500-meter highlands who were used to working in lowland areas. It was discovered that an increase of pressure to 0.3 Kgf/cm^2 (equivalent to the pressure at a simulated 1,250-meter height) for 60 minutes exerted a considerable effect on: the notable increase of oxygen pressure in air sacs ($p < 0.001$), decreases in breathing frequency, amount of ventilation, heart rate, index for blood tuidong [2236 0520], index for xin beng fu he [1800 3119 62985440]; and an increase in the oxygen-carrying amount per pulse. Regardless of whether a person has just arrived at the highland after generations of residence in sealevel places, has practiced service at varying elevations for more than 6 months or has demonstrated acute or chronic maladjustment to high altitude, similar changes surfaced during pressure increases. While asleep, the pressure is being increased at degrees of 0.15 Kgf/cm^2 for 6 hours, then the pressure is reduced to 0.23m/S. The practice has a notably relaxing effect on certain symptoms of acute altitude maladjustment (e.g., sinus tachycardia, too low pulse pressure and oxygen deficiency as diagnosed by electrocardiogram). Certain chronic maladjustment symptoms caused by high altitude (such as high blood pressure, too low pulse pressure and relatively high speed in basic heart rate) are being improved. For people who did not have service practice, it is beneficial to adopt the compression method to add and then reduce pressure. The Army Units Health Research Institute of the Military Medical Academy reported the effect of acute decompression and oxygen deficiency on the artery blood oxygen gradation of air sacs and the relationship between oxygen deficiency from acute decompression and altitude reaction. From observations of the changes in urination amount, urine lactic acid, pyruvic acid and acetone bodies, it was found that with acute oxygen deficiency at 5,000 meters, there were a reduction in urination amount, an increase in the concentration of urine acetone bodies, uric acid and pyruvic acid. All the changes are closely related to the degree of reaction during acute oxygen deficiency.

Navigation medical science and special environment physiology are indeed broad subjects interrelated with many new disciplines. The examples outlined above by no means exhaust the field.

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VISUAL RECOVERY FROM INTENSE FLASHES

Shanghai XINLI KEXUE TONGCUN [INFORMATION ON PSYCHOLOGICAL SCIENCES] in Chinese No 4, 1984 pp 4-

[Article by Ji Zhengyi [0679 1767 5669] of the Shanghai University of Science Educational Services Office and Fang Yunqiu [2455 5366 4428] of the Department of Psychology, East China Teachers' College]

[Text] Introduction

After being stimulated by an intense flash of light, the human eye requires a certain period of time before vision recovers to the resolution level. The vision recovery process is basically one of darkness adaptation. However, it is also different from darkness adaptation. Because of the brief duration of stimulation by an intense flash (the period of stimulation is usually less than one second), the recovery time is shorter than the dark adaptation time[1]. Others before us have studied the recovery of vision after an intense flash. The range of exposure times they used in their research was fairly narrow and was concentrated around a time period of 10 milliseconds or less[2]. Based on actual requirements, we did some research on this question. The exposure times used in our research were less than 5 milliseconds and more than 200 milliseconds. Moreover, relatively few time points were used[3,4]. The primary task of this experiment was to study the relationship between flash and recovery times at constant flash intensities and with a time of exposure of 20 to 1,000 milliseconds. The special characteristics were that a broad range of exposure times was used, along with a small number of time points (seven altogether). The goal was to explore the relationship between exposure times and recovery times within this range. The experiment also included a study of the relationship between target luminance and recovery time.

I. Experimental Instruments and Procedures

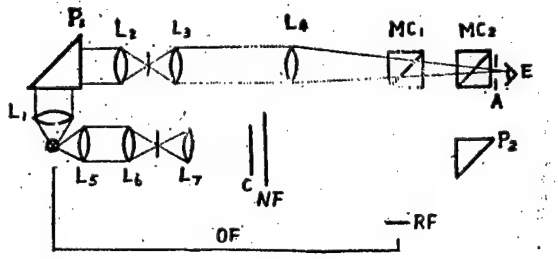
The light path system used in the experiment is shown in Figure 1. The light source was a 60-watt bromine tungsten bulb. The light passed from the light source lenses L1 to L3 and prism P1, forming a parallel light beam. It then passed through lens L4, causing the parallel light to pass through the artificial pupil and be focused on the eye of the subject, E. The focal length was 165 mm, forming a flash field of vision with a 5.6° viewing angle.

The artificial pupil was 3 mm in diamter. The unattenuated luminance of the flash after passing through the light mixing cubes MC1 and MC2 was 1.3×10^4 stilbs. The square wave sent out from the stimulator controlled the opening and closing of shutter S1, thereby controlling the time of exposure. This experiment used exposure times of 20, 40, 70, 200, 400, 700 and 1,000 milliseconds.

The target appearance system was formed of lenses L5 to L7, prism P2 and the light mixing cube MC2. The target was a transparent (?landauite) ring [landau huan 5663 6670 3883] C on photographic film. The notch azimuth could be moved in four directions: up to the right, down to the right, up to the left and down to the left. The ratio between the target and background luminances was greater than two logarithmic units. A sheet of semitransparent dispersion paper was affixed to the top of the film, and the target was 322 mm from the eye. The notch in C formed a 7' viewing angle. The luminance was changed using a neutral filter, NF. The target luminance used in the experiment was 1.5×10^{-2}, 4.4×10^{-3} and 3.7×10^{-4} stilbs. Target appearance was controlled by S_2, as the square wave emitted by the stimulator simultaneously opened S_2 (appearance target) and closed S_1. A red visual attention point was placed directly above the (?landauite) circle at a viewing angle of approximately 0.5°. The light path was formed by an optical waveguide fiber, a red wideband filter RF, and a light mixing cube MC1.

A model 401 electric seconds counter recorded the measured recovery times, and the opening and closing of the timer was synchronized with S2. The experiment was carried out in a dark room, and the light scattered by the light source was covered with black paper.

Figure 1. Diagram of the Light Path Used in the Experiment



Key:

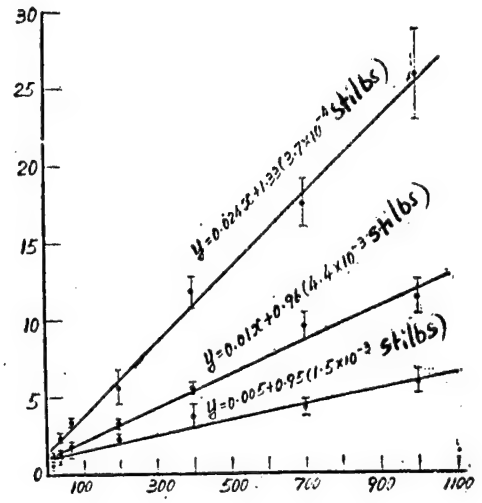
Br L = Bromine tungsten lamp [as published]
L1-L7 = Lenses
S = Shutter [as published]
P = Prism
MC = Light mixing cube
A = Artificial pupil
C = Landauite circle [target]
NF = Neutral filter
OF = Optical fiber
RF = Red wideband filter
E = Eye of the subject

Eight university students with normal vision participated in the experiment. They were given 20 minutes of dark adaptation prior to the experiment, during which time a chin supporter was adjusted so that the axis of vision was aligned with the center of the artificial pupil and with the visual attention point in front of it. After the eye received a certain flash, we immediately observed the rapid and accurate reaction toward the azimuth of the notch in target C. The reaction key was pressed immediately after the notch azimuth was seen clearly. Next, the azimuth was reported orally and the accurate reaction recovery time was recorded by an electrical seconds counter. The target notch azimuth and the exposure time were presented in a random sequence. Each exposure time at the same target luminance was done three times and three averages were drived. Afterwards, the basic reaction time without a flash was subtracted to derive the recovery time after the flash. In order to avoid cumulative effects from the flashes, the flashes were separated by 1 to 4 minutes depending on different flash energies.

II. Results and Discussion

The results of the experiment are shown in Figure 2. It can be seen from Figure 2 that, under conditions of identical target luminance with an exposure time of 20 to 1,000 milliseconds, there was a linear relationship between the flash exposure time and the recovery time. Only one flash luminance was used in this experiment. The flash energy, obtained by multiplying the flash luminance by the exposure time, also has a linear relationship with the recovery time. The conclusions of other researchers and the results we obtained on previous occasions also show this type of relationship. That is to say, the effect of a flash luminance of 1.4×10^4 stilbs and an exposure time of 20 to 1,000 milliseconds on the recovery time and the effect of a flash of less than 10 milliseconds or more than 200 milliseconds are basically identical. The target luminance is shown as the horizontal axis and the recovery time is shown as the vertical axis. The results are shown in Figure 3.

Figure 2. Regression Lines for Exposure Time and Recovery Time

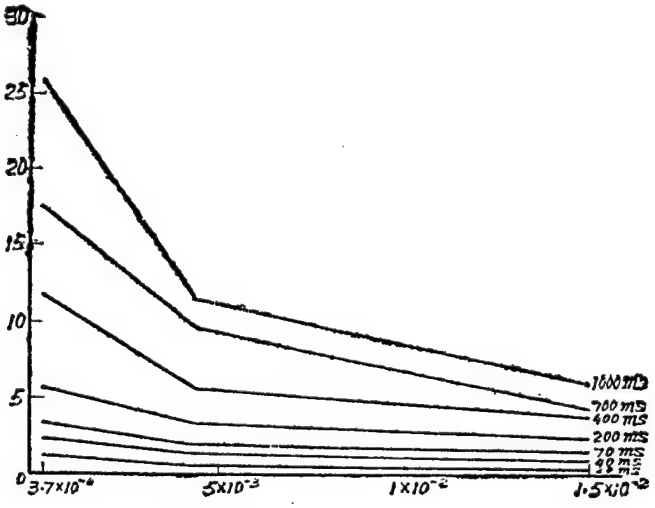


Key:

The horizontal axis shows the exposure time in milliseconds.

The vertical axis shows the recovery time (in seconds). The figures in parentheses are the target luminance figures. The lines for a target luminance of 3.7×10^{-4} and 4.4×10^{-3} stilbs are the experimental results for 8 subjects. The target luminance of 1.5×10^{-2} stilbs is the experimental result from retesting 5 of the 8 subjects.

Figure 3. The Relationship Between Target Luminance and Recovery Time



Note: The figure above each curve is the intense flash exposure time.

It can be seen from Figure 3 that there is an inverse relationship between recovery time and target luminance, and that the greater the target luminance, the smaller the scope of changes in the recovery time. This is expressed as a curve of relatively small slope, and the curve assumes a horizontal slope after the target luminance is increased to a certain value. Similarly, the lower the flash energy, the smaller the slope of the curve. This means that the effects of changes in target luminance on the recovery time are unclear at this time. This result is of real applied significance. In actual work, if we wish to use the method of increasing target luminance to reduce recovery time, the experimental results show that it plays an obvious role in the beginning. After the target luminance reaches a certain value, it appears that additional increases in target luminance cause no further reductions in recovery time. Using 200 milliseconds from Figure 3 as an example, when the target luminance is increased from 3.7×10^{-4} to 4.4×10^{-3} stilbs, an increase of 4.4×10^{-3} stilbs, the recovery time is reduced by 2.43 seconds. When the target luminance is increased from 4.4×10^{-3} to 1.5×10^{-2} stilbs, however, an increase of 1.1×10^{-2} stilbs, the recovery time is reduced by only 0.9 seconds. Secondly, when the flash energy is relatively high, the results of increasing target luminance to reduce recovery times are fairly good. This type of result is not very obvious when the flash energy is fairly low. Figure 3 shows that when the target luminance is increased from 3.7×10^{-4} to 4.4×10^{-3} stilbs, an increase of 4.0×10^{-3} stilbs, with an exposure time of 1,000 milliseconds, the recovery time drops from 25.77 seconds to 11.40 seconds, a reduction of 14.37 seconds. When the exposure time is 20 milliseconds, the recovery time drops by only 0.67 seconds. In actual work, we can determine the optimum target luminance according to the amount of recovery time and the value of flash energy.

III. Conclusion

Under darkroom conditions, for 8 test subjects with normal vision, we measured the relationship between exposure time, target luminance and recovery time. The results are as follows:

1. Under the conditions of this experiment, there was a linear relationship between recovery time and exposure time.

2. There is an inverse relationship between target luminance and recovery time within a certain range.

3. The curve shows a tendency to flatten out the lower the flash energy or the higher the target luminance.

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ACHIEVEMENTS AND DEVELOPMENTS IN CHINESE MEDICINE

Beijing ZHONGHUA YIXUE ZAZHI [NATIONAL MEDICAL JOURNAL OF CHINA] in Chinese No 5, 15 May 84 pp 319-323

[Article by Huang Jiasi [7806 1367 7475], President, Chinese Academy of Medical Sciences and Gao Changlie [7559 2490 3525], Medical Intelligence Institute, Chinese Academy of Medical Sciences: "Domestic and Foreign Progress in Medicine"]

[Excerpt] Achievements and Developments in Chinese Medicine (pp 322-323)

1) China's Achievements in Health Care and Medical Science:

Since the founding of the nation, under the guidance of correct party policies, and after more than 30 years of hard work, China's health care industry has achieved enormous success, and in the area of medical research, very good results have also been achieved. China has eliminated smallpox, virtually eliminated and brought under control the plague, venereal disease, kala-azar, poliomyelitis and many other kinds of infectious diseases. China has to a great extent lowered the incidence of schistosomiasis, malaria, leprosy, encephalitis-B, and other diseases. There have been marked achievements in the areas of pharmaceuticals, antibiotics, biologicals, and medical instruments and apparatus. Accomplishments in the treatment of extensive burns, in the replantation of severed limbs and in nationalized tumor epidemiology surveys are outstanding, attracting international attention. Combining Chinese and Western medicine to treat diseases such as acute abdominal disease and arm and leg fractures has not only achieved good results, but theoretically speaking, has changed some traditional viewpoints in Western medicine. The field of acupuncture anesthesia, on the basis of achieving good clinical results, has already made headway in research on its principle of action. The scale and accomplishments of medical science research are all unparalleled compared to pre-Liberation times. Many medical science research projects have won state prizes for achievement and awards for inventions. One that is particularly worth mentioning is China's public health work at the grassroots level. China's grassroots health organizations receive little investment but achieve high results. They have solved the problems of medical prevention services for the broad masses which a flourishing state could not solve, receiving a great deal of national attention. The World Health Organization has already set up three cooperation centers and conducted eight or nine study groups on international advances with health officers from 90 countries participating to understand China's rural three-tiered medical and health network and to exchange experience, learning from each other. In short, the developments in health care and medical science have promoted industrial and agricultural production and raised the people's standard of living, enabling the people's health to improve and lengthening the average life expectancy.

2) The Gap Between China's Medical Science and Advanced-World Standards:

In spite of the great successes in public health work, from the standpoint of medical science standards, we are still a long way from advanced-world standards. This is mainly apparent in two respects: the first is that theoretical research work in medical science is weak. China has consistently advocated combining popularization with the raising of standards, combining theory and practice. But for many years, because the foundation of China's medical prevention facilities has been weak and there have been shortages in the number of doctors and hospital beds based on average population, there are many diseases seriously damaging to people's health, and it cannot be denied that while the amount of popularization work is great, improved work standards have not kept pace. There is a great deal of practice of preventative and curative medicine. Basic theoretical research is weak. However, not concentrating on raising results, with little theoretical discussion and no theoretical reserves, is bound to hinder progress in preventative practice and popularization work. Some diseases have been basically brought under control but not completely wiped out. Some diseases to date have no effective method of prevention. Questions involving the causes of diseases and their mechanisms of incidence must be solved on a theoretical basis. We must admit that after the fall of the gang of four, and especially since the 3d Plenary Session of the 11th Party Central Committee, there has been progress in theoretical research, but generally speaking, the level is not high and depth and breadth are inadequate. Second, the utilization of new technology is insufficient, and methods of diagnosis and treatment and scientific experimentation are backward. This all causes our research work to be shallow, too slow, and unproductive. In recent years, China has paid more attention to this facet of work, and some units are developing new technology, genetic engineering and hybrid lymph cell tumor technology. Laser and ultrasonic technology are being used clinically, and some units have begun to use computers. An Institute of Biomedical Engineering has been set up. With respect to academic exchange, there are national and local biomedical engineering associations. However, our initial steps are late, small, and not far-reaching. The importation and development of new technology, new medical instrumentation and new equipment have already become the necessary conditions for the development of medical science.

3) The Direction of Future Developments in Chinese Medicine:

The development of medicine in China must take reality as its starting point, travel its own independent course, and meet the demands of realizing the four modernizations by the end of this century. At present, both China's health care work and medical science have a definite foundation. Since the 3d Plenary Session of the 11th Party Central Committee, the enthusiasm of numerous medical science workers has been high, China has the three contingents of Chinese traditional medicine, Western medicine and combined Chinese and Western medicine. However, China is a large nation with a population of 1 billion, and it is a poor nation with a fragile economic foundation. Consequently, no matter what medical preventive facilities we choose and arrange for or what questions for scientific inquiry we decide on and organize, we all must pay the closest attention to the problem of economic results. In addition, our theoretical reserves in medical science are very limited, and utilization of new technology is very insufficient. Starting out from this basic situation, the priorities for developments in China's medical science should be:

1. The study of crucial scientific and technical questions of preventive measures of all kinds of diseases which are seriously harmful to people's health: This has always been a priority question for research in China, and in the past 30 years some outstanding successes have been achieved. But it is necessary to see that although many infectious and parasitic diseases have already been brought under control, they have still not been wiped out. Some other acute and chronic infectious diseases are still plentiful; hepatitis is still a serious problem. Along with increased life expectancy, cardiovascular disease, tumors and diseases of the respiratory system are already major causes of death. There is an urgent need to strengthen research on these diseases. Along with the development of economic construction and the increase in modern means of transportation, the problem of environmental pollution gets worse every day. It is necessary to study and coordinate China's actual means to solve these problems.

2. At the same time we are improving utilization of research, we must concentrate on basic theoretical research, using new technology:

Medicine uses science and great amounts of research work to solve problems of medical science technology which are encountered in prevention and care of diseases. But up to now, our current state of knowledge cannot solve the problems of science and technology that we have encountered. Consequently, we must engage in basic theoretical research and move forward in understanding the innate character of diseases, thereby selecting measures which are more directly aimed at the diseases. In medical research, basic research actually refers to applying basic research. It is to serve practical applications, and there are no insurmountable barriers in practical work. From the perspective of foreign developments in medicine, we should strive to develop several exemplary courses, for example, in molecular biology, cell biology, immunology, genetics, biomedical engineering and others. With respect to new technology, we should develop and spread genetic engineering and hybrid lumph cell tumor technology.

3. The continued development of the three contingents of Chinese traditional medicine, Western medicine and combined Chinese and Western medicine:

The formation of the three contingents of Chinese medicine, Western medicine, and combined Chinese and Western medicine is a triumph of China's public health policy. The combination of Chinese and Western medicine integrates Chinese and Western medicine, using modern scientific methods to systematize the strengths of Chinese medicine. Their ranks are still few and must continue to be developed. The task of Chinese medicine is to carry forward and develop our national medicine, training a new generation. Western medicine develops very fast internationally. China in many respects--especially in theoretical research--is still relatively far behind. We must exert enormous efforts to strengthen and catch up with advanced international standards.

4. Strengthened family planning and research on optimum birth and child care:

Family planning is the basic national policy of China. It directly affects the realization of our national economic policy and improvement in people's living standards. In many aspects of family planning work, we occupy a leading position

internationally, but with respect to providing safer pills and devices and technical measures more acceptable to the people, we still need to do deeper research. Scientific research work on optimum birth and child care is an urgent requirement of the broad masses. In the future we need to make a big effort to strengthen this.

In short, looking at the existing state of affairs of medical science development inside and outside China, at present we are in a period of monumental change in the course of events. Perhaps in the not too distant future there will be a major breakthrough. In order for our nation to accomplish modernization in medicine, we must, under the guidance of correct party policy, and starting from China's realities, study foreign advanced experience, respect the laws of development in medicine, hasten our steps, strengthen coordination, be of one heart and one mind, and vigorously struggle. The peoples of China can definitely make contributions to world medicine.

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ANALYSIS OF CHROMOSOME ABERRATIONS IN PERIPHERAL BLOOD OF NUCLEAR INDUSTRY WORKERS

Taiyuan FUSHE FANGHU [RADIATION PROTECTION] in Chinese No 4, Jul 83 pp 293-297

[Article by Cao Shuyuan [2580 3219 1254] and Zhou Zhenying [6650 2182 5391], North China Institute of Radiation Protection]

[Text] An analytical study on 80 nuclear industry workers, specifically on the correlation between the amount of chromosome aberration in peripheral blood and the cumulated doses of radiation, is reported here. By 1980, we had kept a record of these workers for more than 5 years. A large number of the workers under study have undergone 2 or 3 times of study and analysis on their peripheral blood chromosome aberrations. The study result shows that both fragment occurring rate and rate for non-stable type cell aberration occurrence correlate with cumulated dose. The relation can be expressed by the linear equation $Y = a + bX$.

The practical use of chromosome aberrations rate in accidental irradiation as a biological gauge of radiation does is widely recognized. In slow low-level irradiation such as occupational irradiation, is there also a quantitative dose-effect relation? So far, there has not been an unanimous conclusion. Norman [1-3] and his colleagues, for instance, have reported that the aberration rate for the irradiated personnel is notably higher than that for the control group. Yet not correlation has been found between rate of aberrations and cumulated dose. Evans[4] and his fellow researchers, on the other hand, came out with very different conclusions. Ten years of cumulative observations on 197 cases (365 case-time) of a nuclear submarine building and repair plant workers' chromosome aberrations have revealed apparent increase in chromosome injuries along with the increase in radiation dose. Evans et al. point out the need to consider several factors: age, time the sample is taken, the interval between two irradiations. Lloyd et al. reported that the chromosome aberrations in radiation occupation workers, as examined in either diplonema or fragment, did not increase along with cumulated dose. However, if the non-stable type aberrant cells in half of their life circles (3 years) as contrasted with the weighted cumulated dose is taken into consideration, a dose-effect linear relationship can be detected.

Our research group has studied the chromosome aberrations in peripheral blood of workers in a certain nuclear fuel production plant during 1975 and 1978[6, 7]. In this paper we report the investigation completed in 1980 along with the data gathered in the two previous studies for a preliminary analysis of the relationship between dose and effect.

1. Personnel Grouping and Research Method

Seventy male workers in the nuclear plant are being studied. They are grouped by type of work: 14 workers in the Reactor Group, ages from 25 to 45; 46 in the Reprocessing Group, ages from 30 to 50; and 15 in the Control Group, personnel working on non-radioactive jobs.

Chromosome aberrations are studied using the whole-blood micromethod. Venous blood is drawn to be cultured for 54 hours. Colchicine is added 6 hours before harvesting and then flaking through air-dying process. For each sample, we generally study 200 metaphase cells. Any detected chromosome aberrations have to be double checked by another researcher before they enter the statistical data.

2. Individual Dose

The two groups of workers in radioactive environments are being irradiated by x-ray. Individual y-dose is measured by film badge. Table 1 lists average annual dose. From thedata gathered through measurement over the years, the average annual y-dose for the two groups are 1.79 R and 1.62 R respectively. The annual dose for the largest majority of the workers is within the limit of 5 R. Only 6 percent of the total monitored data (324) are over 5 R.

3. Results of Studies on Chromosome Aberrations

Table 2 lists the 1980 study results. The results from the two previous studies are listed also for comparisons.

Of the three groups totaling 75 workers, only seven workers are undergoing sampling for the first time. The rest are follow-up examinations for the 2d or 3d times.

Table 1 Annual y-Dose for Workers*

Group	Year	Average Dose, R	Scope,R	Group	Year	Average Dose,R	Scope, R
Reactor	1975	1.99	0.07-5.50	Repro-cessing	1976	0.80	0.12-3.30
	1976	1.16	0.03-5.88		1977	1.88	0.03-8.04
	1977	1.87	0.18-9.05		1978	1.90	0.25-7.63
	1978	1.61	0.05-8.99		1979	1.77	0.12-8.20
	1979	2.26	0.05-9.78				
	Avg. Value over the yrs.**	1.79± 1.92			Avg. value over the yrs.**	1.62± 1.65	

* Radioactive background has been subtracted

**Average value over the years is the weighted average value of the number of people over the years

Table 2 Chromosome Aberrations Studies Report in Three Studies

Group	Year	Number of Workers	Number of Cells	Fragment	Chromosome Aberrations					
					Deletion	Trans-location	Diplonema	Ying	Total aberrant cells	%
Control	1975	15	2705	8					8	0.30
	1977	13	2292	6/5c*					5	0.22
	1980	15	3000	9	1		1		11	0.37
	Sub-total	19	7997							
Reactor	1975	18	3575	23	1	2	1		25	0.70
	1977	31	6445	26/19c	4/3c	2			24	0.37
	1980	14	2700	29/26c	3	1	2		32	1.18
	Sub-total	40	12720							
Repro-cessing	1975	30	4756	5					5	0.11
	1977	48	9587	61/50c	6	12	5	1	71	0.74
	1980	46	9200	71/60c	7/6c	4	11/9c	1	76	0.83
	Sub-total	70	23543							

*indicating 5 cells containing 6 fragments.

Table 2 shows that for the 15 control group workers, the rate for cells with chromosome aberrations in 1980 is 0.37 percent which is quite close to the previous two studies records (0.3 percent and 0.22 percent).

For the fourteen cases in the 1980 Reactor Group, of the 2700 metaphase under study, 1.18 percent underwent chromosome aberrations. Compared with the Control Group, the increase is striking. Compared with the previous two studies (0.70 percent, 0.37 percent) the increase is also noteworthy.

For the Reprocessing Group, the 1975 figure is the radioactive background as recorded before the workers started engaging in radioactive work. The 1977 second study shows an aberration rate at 0.74 percent which is obviously higher than the radioactive background (0.11 percent) and the Control Group (0.22 percent). The forty six cases of the 1980 study shows an aberration rate at 0.83 percent which is higher than for the control group (0.37 percent) and the 1977 record (0.74 percent).

Compared with the control group, the two irradiated groups have not only higher aberration rate but also more types of aberrations as demonstrated in: the increase in diplonema discerning rate (irradiated groups: 5.24×10^{-4}, Control Group: 1.25×10^{-4}); the appearance of rings and the appearance of more multiaberrant cells--those cells which contain two fragments or two deletion or two diplonema, or containing both translocation and rings. Discerning rate for cells which have more than two aberrations in the reprocessing group is 9.2 percent (7/76).

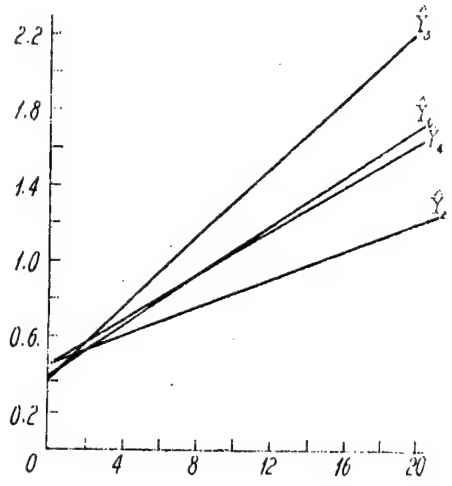
4. Correlation between Chromosome Aberrations Rate and Cumulated Dose of Radiation

The chromosome aberrations rates arrived at from the three studies on the two irradiated groups can each be grouped each three categories: chromosome fragment (including deletion), diplonema (including ring), and total non-stable type aberrant cells (Cu), which are further grouped according to different cumulated dose, with 2 R difference between groups. The aberration rates are listed in Table 3 and Table 4.

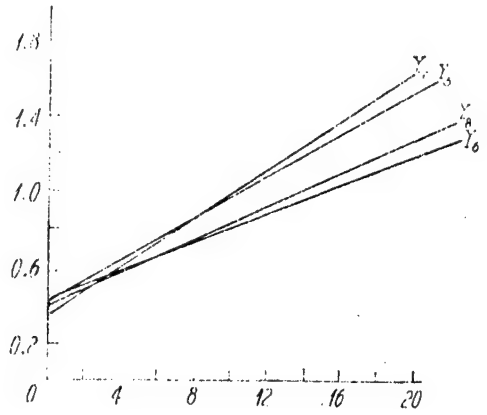
Results from the correlation and regression analyses of the cumulated dose and chromosome aberrations of the 75 samples in the Reactor Group and the 92 samples in the Reprocessing Group, are listed in Table 5.

From table 5 we can see that (1) the cumulative dose and the chromosome aberrations fragment rate; the cumulated dose and the non-stable type aberrant cells occurrence rate both correlate positively with the coefficients of correlation y greater than $y_{0.05}$; (2) simulated integrated regression equations are tenable i.e. linear regression statistical relationship exist between the cumulated dose and the fragment rate and the non-stable type aberrant cells occurrence rate. The regression line of the equations expressed in Table 5 can be graphed in the following two pictures:

Chromosome aberrations/cell, 10^{-2}



Graph 1 Cumulated radiation amount Reactor Group Fragment Rate (Y_1 , Y_3) and Cu occurrence Rate (Y_2, Y_4) and their Relationship with Cumulated Dose



Graph 2 Cumulated radiation amount Reprocessing Group Fragment Rate (Y_5.Y_7) and Cu Occurrence Rate (Y_6 Y_8) and Their Relationship with Cumulated Dose

Table 3
Reactor Group Chromosome Aberration Rates
as Shown in Different Cumulated Doses

Cumulated Dose (R)		No of Samples	No of cells observed	Fragment (1)		Diplonema (2)		Cu	
Group	Avg.Value			Number	%	Number	%	Number	%
0(3)	0	15	3000	10	0.33	1	0.03	11	0.37
0.1-2.0	1.24	24	4810	27	0.56	1	0.02	27	0.56
2.1-4.0	3.41	10	2210	18	0.81	0	0	18	0.81
4.1-6.0	5.02	10	2000	5	0.25	1	0.05	6	0.30
6.1-8.0	6.94	6	1100	5	0.45	0	0	5	0.45
8.1-10.0	9.20	5	1050	11	1.04	0	0	10	0.95
10.1-12.0	10.12	1	200	8	4.0	0	0	2	1.0
12.1-14.0	13.88	1	200	0	0	0	0	0	0
14.1-16.0	15.14	2	400	6	1.5	1	0.25	4	1.0
18.1-20.0	18.71	1	200	4	2.0	0	0	4	2.0

(1) including deletion

(2) including ring

(3) 1980 Control Group (Table 2)

Table 4

Reprocessing Group Chromosome Aberrations Rates
as Shown in Different Cumulated Doses

Cumulated Dose (R) Group	Average Value	No of Samples	No of Cells Observed	Fragment (1) Number	%	Diplonema (2) Number	%	Cu Number	%
0(3)	0	20	2909	1	0.03	0	0	1	0.03
0.1-2.0	1.28	16	3300	22	0.67	2	0.06	20	0.60
2.1-4.0	2.95	22	4350	41	0.94	4	0.09	39	0.89
4.1-6.0	5.01	14	2710	16	0.59	4	0.15	18	0.66
6.1-8.0	6.74	8	1586	14	0.88	1	0.06	13	0.82
8.1-10.0	9.78	2	400	2	0.50	1	0.25	3	0.75
10.1-12.0	11.07	4	800	0	0	1	0.13	1	0.13
12.1-14.0	12.67	3	600	13	2.2	0	0	4	0.67
14.1-16.0	14.50	1	200	1	0.5	0	0	1	0.50
16.1-18.0	17.65	1	200	5	2.5	2	1.0	6	3.0
18.1-20.0	18.42	1	200	0	0	0	0	0	0

(1), (2) same as in Table 3

(3) The twenty cases as shown in Table 2, i.e., the 1975 rates of the Reprocessing Group workers before staring radioactive work, who have been followed, are used as control figures.

Table 5

Correlation and Regression Analyses of the Reactor Group and Reprocessing Group Cumulated Doses and the Chromosome Aberration Fragment Rate and Non-Stable Type Aberrant Cells (Cu)

Group	Number of Samples	r	$\hat{Y} = a + bx$
Reactor group fragment rate	75(1)	0.375**	$\hat{Y}_1=0.3916 \times 10^{-2}=0.0657 \times 10^{-2}x$
Reactor Group CU Occurrence Rate	75	0.268*	$\hat{Y}_2=0.4478 \times 10^{-2}+0.0377 \times 10^{-2}x$
Reactor Group Fragment Rate	44(2)	0.422**	$\hat{Y}_3=0.3846 \times 10^{-2}+0.0918 \times 10^{-2}x$
Reactor Cu Occurrence Rate	44	0.352*	$\hat{Y}_4=0.4501 \times 10^{-2}+0.0586 \times 10^{-2}x$
Reprocessing Group Fragment Rate	92(3)	0.234*	$\hat{Y}_5=0.4078 \times 10^{-2} +0.0552 \times 10^{-2}x$
Reprocessing Group Cu Occurrence Rate	92	0.205*	$\hat{Y}_6=0.4342 \times 10^{-2} +0.0374 \times 10^{-2}x$
Reprocessing Group Fragment Rate	87(4)	0.282**	$\hat{Y}_7=0.3419 \times 10^{-2} +0.0642 \times 10^{-2}x$
Reprocessing Group Cu Occurrence Rate	87	0.252*	$\hat{Y}_8=0.3886 \times 10^{-2} +0.443 \times 10^{-2}x$

(1) including the 15 cases of the Control Group

(2) omitting the 15 cases of the Control Group and the 16 cases which underwent just one examination

(3) including the 20 samples taken from workers before start working in radioactive environment

(4) omitting the 5 cases where only 1 examination is made.

* $r \geq r_{0.05}$

** $r \geq r_{0.01}$

5. Discussion

A. Table 5 and pictures 1 and 2 show that there is positive correlation between the chromosome fragment rate, the non-stable type chromosome aberrant cell occurrence rate with the cumulated dose. The result is similar to the report of Evans[4] et al. With regard to age factor, from the control group chromosome aberrations follow up observations listed in Table 6, we see no apparent changes in self developed aberrations after 2-5 years. We conclude that age is not a major factor concerning the correlation between the chromosome aberrations and the increase in cumulated dose from radioactive occupations. However, since the period under observations is still quite short (5 years) and the cumulated dose is still low (20 R), we need to observe continuously after the current preliminary findings.

Table 6 Follow Up Study on the Chromosome Aberrations of the Control Group Workers

Group	Study Year	Number of Cases	Chromosome Aberrant Cells, Occ. Rate, %
Uranium Mine[8]	1974	11	0.40
Control Group	1976	11	0.42
Tin Mine[9]	1976	9	0.44
Control Group	1980	9	0.39
Current Study	1975	8	0.26
Control Study	1977	8	0.15
	1980	8	0.31

B. It is more difficult to study the relationship between chromosome aberrations and small amount of slow continuous dose of radiation than for single relative large dose of radiation mainly because the condition is far more complicated. More factors could affect the study, for instance: individual differences, differences in rate dose, different types in the cumulated dose time, and the dynamic changes in non-stable type of aberrant cells. These factors could produce different chromosome aberrations variables even though the subjects are under identical dose of radiation, thus covering up possible quantitative relationship between dose and effect.[10] Our study and Evans[4] et al.'s study have arrived at similar

conclusions, namely, the chromosome aberrations in personnel under radiation increase with the increase in dose. Both are studies following up a group of entities under the same conditions. Since the objects for observations are under uniform conditions, the linear relationship between dose and aberrations is easily expressed.

C. The results of this study suggest that of all the aberration types under observation including fragment acentricity, translocation, diplonema and ring, regardless whether it is fragment (including deletion) occurrence rate or total non-stable type aberrant cells occurrence rate, positive correlation can be observed in relation to cumulative dose. No pronounced differences can be observed between the two coefficients of correlation. In observing the small amount slow radiation effects, the count of chromosome fragment is a relatively more important indicator.

The author would like to thank Professor Li Deping for his guidance while writing this article.

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